United States Department of Agriculture

Maternal Diet during Pregnancy and Lactation and Risk of Child Food Allergies and Atopic Allergic Diseases: A Systematic Review

2020 Dietary Guidelines Advisory Committee,
Pregnancy and Lactation Subcommittee

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Nutrition Evidence Systematic Review
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This systematic review was conducted by the 2020 Dietary Guidelines Advisory Committee in collaboration with the Nutrition Evidence Systematic Review (NESR) team at the Center for Nutrition Policy and Promotion, Food and Nutrition Service, U.S. Department of Agriculture (USDA). All systematic reviews from the 2020 Advisory Committee Project are available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews.

Conclusion statements drawn as part of this systematic review describe the state of science related to the specific question examined. Conclusion statements do not draw implications, and should not be interpreted as dietary guidance. This portfolio provides the complete documentation for this systematic review. A summary of this review is included in the 2020 Advisory Committee's Scientific Report available at www.DietaryGuidelines.gov.

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USDA and HHS implemented a process to identify topics and scientific questions to be examined by the 2020 Dietary Guidelines Advisory Committee. The Committee conducted its review of evidence in subcommittees for discussion by the full Committee during its public meetings. The role of the Committee members involved establishing all aspects of the protocol, which presented the plan for how they would examine the scientific evidence, including the inclusion and exclusion criteria; reviewing all studies that met the criteria they set; deliberating on the body of evidence for each question; and writing and grading the conclusion statements to be included in the scientific report the 2020 Committee submitted to USDA and HHS. The NESR team with assistance from Federal Liaisons and Project Leadership, supported the Committee by facilitating, executing, and documenting the work necessary to ensure the reviews were completed in accordance with NESR methodology.

[i] Under contract with the Food and Nutrition Service, United States Department of Agriculture.

More information about the 2020 Dietary Guidelines Advisory Committee, including the process used to identify topics and questions, can be found at www.DietaryGuidelines.gov. More information about NESR can be found at NESR.usda.gov.

The Committee and NESR staff thank USDA's Agricultural Research Service for coordinating the peer review of this systematic review, and the Federal scientist peer reviewers for their time and expertise.

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INTRODUCTION

This document describes a systematic review conducted to answer the following question: What is the relationship between maternal diet during pregnancy and lactation and risk of child food allergies and atopic allergic diseases? This systematic review was conducted by the 2020 Dietary Guidelines Advisory Committee, supported by USDA's Nutrition Evidence Systematic Review (NESR).

More information about the 2020 Dietary Guidelines Advisory Committee is available at the following website: www.DietaryGuidelines.gov.

NESR specializes in conducting food- and nutrition-related systematic reviews using a rigorous, protocol-driven methodology. More information about NESR is available at the following website: NESR.usda.gov.

NESR's systematic review methodology involves developing a protocol, searching for and selecting studies, extracting data from and assessing the risk of bias of each included study, synthesizing the evidence, developing conclusion statements, grading the evidence underlying the conclusion statements, and recommending future research. A detailed description of the systematic reviews conducted for the 2020 Dietary Guidelines Advisory Committee, including information about methodology, is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews. In addition, starting on page 171, this document describes the final protocol as it was applied in the systematic review. A description of and rationale for modifications made to the protocol are described in the 2020 Dietary Guidelines Advisory Committee Report, Part D: Chapter 2. Food, Beverage, and Nutrient Consumption During Pregnancy and Chapter 3. Food, Beverage, and Nutrient Consumption During Lactation.

List of abbreviations

Abbreviation	Full name
ALSPAC	Avon Longitudinal Study of Parents and Children
DP	Dietary pattern
DII	Dietary Inflammation Index
FFQ	Food frequency questionnaire
HEI	Healthy Eating Index
HDI	Human Development Index
HHS	Department of Health and Human Services
IgE	Immunoglobulin E
NESR	Nutrition Evidence Systematic Review
NRCT	Non-randomized controlled trial
RCT	Randomized controlled trial
SES	Socioeconomic status
USDA	United States Department of Agriculture

PLAIN LANGUAGE SUMMARY

What is the question?

- The question is: What is the relationship between maternal diet during pregnancy and lactation and risk of child food allergies and atopic allergic diseases?

What is the answer to the question?

Diet during pregnancy and risk of child food allergy

- Insufficient evidence is available to determine the relationship between lower or restricted consumption of cow milk products during pregnancy only, or during both pregnancy and lactation, and risk of food allergy in the child.
- Insufficient evidence is available to determine the relationship between peanuts, eggs, or wheat consumed during pregnancy and risk of food allergy in the child.
- Limited evidence suggests no relationship between soybean consumed during pregnancy and risk of food allergy in the child.
- No evidence is available to determine the relationship between maternal dietary patterns or fish, tree nuts and seeds, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during pregnancy and risk of food allergy in the child.

Diet during lactation and risk of child food allergy

- Insufficient evidence is available to determine the relationship between lower or restricted consumption of cow milk products during both pregnancy and lactation and risk of food allergy in the child.
- No evidence is available to determine the relationship between maternal dietary patterns or cow milk products, eggs, peanuts, soybean, wheat, fish, tree nuts and seeds, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during lactation and risk of food allergy in the child.

Diet during pregnancy and risk of child atopic dermatitis/eczema

- Moderate evidence indicates that lower or restricted consumption of cow milk products during pregnancy does not reduce the risk of atopic dermatitis/eczema in the child.
- Moderate evidence indicates that lower or restricted consumption of egg during pregnancy does not reduce the risk of atopic dermatitis/eczema in the child.
- Insufficient evidence is available to determine the relationship between cow milk products and eggs restricted during both pregnancy and lactation and risk of atopic dermatitis/eczema in the child.
- Limited evidence suggests that fish consumed during pregnancy does not increase the risk of atopic dermatitis/eczema in the child.

- Limited evidence suggests that dietary patterns during pregnancy are not associated with risk of atopic dermatitis/eczema in the child.
- Insufficient evidence is available to determine the relationship between peanuts, soybean, wheat/cereal, yogurt and probiotic milk products, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits, consumed during pregnancy and risk of atopic dermatitis/eczema in the child.
- No evidence is available to determine the relationship between tree nuts and seeds consumed during pregnancy and risk of atopic dermatitis/eczema in the child.

Diet during lactation and risk of child atopic dermatitis/eczema

- Insufficient evidence is available to determine the relationship between cow milk products restricted during both pregnancy and lactation, or during lactation only, and risk of atopic dermatitis/eczema in the child.
- Insufficient evidence is available to determine the relationship between egg consumption restricted during both pregnancy and lactation and risk of atopic dermatitis/eczema in the child.
- No evidence is available to determine the relationship between maternal dietary patterns or yogurt and probiotic milk products, eggs, fish, peanuts, tree nuts and seeds, soybean, wheat/cereal, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits, consumed during lactation and risk of atopic dermatitis/eczema in the child.

Diet during pregnancy and risk of child allergic rhinitis

- Insufficient evidence is available to determine the relationship between cow milk products (fermented or non-fermented) consumed during pregnancy only, or during both pregnancy and lactation, and risk of allergic rhinitis in the child.
- Moderate evidence indicates that lower or restricted consumption of eggs during pregnancy does not reduce the risk of allergic rhinitis in the child.
- Limited evidence suggests that dietary patterns during pregnancy are not associated with risk of allergic rhinitis in the child.
- Insufficient evidence is available to determine the relationship between fish, peanuts, tree nuts, soybean, wheat, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during pregnancy and risk of allergic rhinitis in the child.
- No evidence is available to determine the relationship between seeds consumed during pregnancy and the risk of allergic rhinitis in the child.

Diet during lactation and risk of child allergic rhinitis

- Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation, and risk of allergic rhinitis in the child.
- No evidence is available to determine the relationship between maternal dietary patterns or cow milk products, eggs, fish, peanuts, tree nuts and seeds, soybean, wheat, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during lactation and risk of allergic rhinitis in the child.

Diet during pregnancy and risk of child asthma

- Limited evidence suggests that a lower consumption of cow milk products during pregnancy does not reduce risk of asthma in the child.
- Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation and risk of asthma in the child.
- Limited evidence suggests no relationship between eggs consumed during pregnancy and risk of asthma in the child.
- Limited evidence suggests no relationship between fish consumed during pregnancy and risk of asthma in the child.
- Insufficient evidence is available to determine the relationship between maternal dietary patterns or peanuts, tree nuts, soybean, and other foods such as wheat/whole grains, vegetables, fruits, beverages, and margarine consumed during pregnancy and risk of asthma in the child.
- No evidence is available to determine the relationship between seeds consumed during pregnancy and risk of asthma in the child.

Diet during lactation and risk of child asthma

- Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation, or during lactation only, and risk of asthma in the child.
- Insufficient evidence is available to determine the relationship between fish, and other foods, such as margarine, oil, butter and butter-spreads, meat, and meat products consumed during lactation and risk of asthma in the child.
- No evidence is available to determine the relationship between maternal dietary patterns or eggs, peanuts, wheat, tree nuts and seeds, and soybean consumed during lactation and risk of asthma in the child.

Why was this question asked?

- This important public health question was identified by the U.S. Departments of Agriculture (USDA) and Health and Human Services (HHS) to be examined by the 2020 Dietary Guidelines Advisory Committee.

How was this question answered?

- The 2020 Dietary Guidelines Advisory Committee, Pregnancy and Lactation Subcommittee conducted a systematic review to answer this question with support from the Nutrition Evidence Systematic Review (NESR) team.

What is the population of interest?

- For the intervention/exposure, generally healthy women during pregnancy and/or lactation.
- For the outcome, infants and toddlers (birth to 24 months) and children and adolescents (ages 2-18 years).

What evidence was found?

Pregnancy[ii]

- This systematic review included 36 articles that presented evidence from 15 studies that included only pregnant women and four studies that included both

pregnant and lactating women.

- Studies looked at cow milk products, eggs, fish, soybean, wheat, peanuts, and tree nuts eaten during pregnancy alone, or during both pregnancy and lactation, as well as dietary patterns and foods not considered to be major allergens, such as meat, fruits, and vegetables eaten during pregnancy and/or lactation, with respect to the outcomes.
- There were a number of limitations including:
    - Outcomes measured by methods with limited reliability.
    - Only a few studies were well-designed randomized controlled trials. Studies were mostly observational and therefore, cause-effect relationships between diet during pregnancy and the child's risk of food allergy, atopic dermatitis, allergic rhinitis, and asthma, were difficult to determine.
    - Potential bias of the studies.
    - There was little racial/ethnic, socioeconomic, and age diversity in the studies.

Lactation[ii]

- This systematic review included eight articles that presented evidence from four studies that included both pregnant and lactating women, and 2 studies that included only lactating women.
- Studies looked at cow milk products, eggs, fish, soybean, wheat, peanuts, tree nuts, as well as dietary patterns and foods not considered to be major allergens, such as meat, fruits, and vegetables eaten during both pregnancy and lactation, or lactation alone, with respect to the outcomes.
- There were a number of limitations including:
    - Very few studies examined the relationship between what mothers ate during lactation alone and the child's risk of food allergy, atopic dermatitis, allergic rhinitis and asthma.
    - Potential bias of the studies.
    - There was little racial/ethnic, socioeconomic, and age diversity in the studies.

How up-to-date is this systematic review?

- This review searched for studies from January 1980 to January 2020.

[ii] Studies with interventions during both pregnancy and lactation are discussed in both pregnancy and lactation sections

TECHNICAL ABSTRACT

Background

- This important public health question was identified by the U.S. Departments of Agriculture (USDA) and Health and Human Services (HHS) to be examined by the 2020 Dietary Guidelines Advisory Committee.
- The 2020 Dietary Guidelines Advisory Committee, Pregnancy and Lactation Subcommittee conducted a systematic review to answer this question with support from the Nutrition Evidence Systematic Review (NESR) team.
- The goal of this systematic review was to examine the following question: What is the relationship between maternal diet during pregnancy and lactation and risk of child food allergies and atopic allergic diseases?

Conclusion statements and grades

Food allergy

Pregnancy

- Insufficient evidence is available to determine the relationship between lower or restricted consumption of cow milk products during pregnancy only, or during both pregnancy and lactation, and risk of food allergy in the child. (Grade: Grade not assignable)
- Insufficient evidence is available to determine the relationship between peanuts, eggs, or wheat consumed during pregnancy and risk of food allergy in the child. (Grade: Grade not assignable)
- Limited evidence suggests no relationship between soybean consumed during pregnancy and risk of food allergy in the child. (Grade: Limited)
- No evidence is available to determine the relationship between maternal dietary patterns or fish, tree nuts and seeds, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during pregnancy and risk of food allergy in the child. (Grade: Grade not assignable)

Lactation

- Insufficient evidence is available to determine the relationship between lower or restricted consumption of cow milk products during both pregnancy and lactation and risk of food allergy in the child. (Grade: Grade not assignable)
- No evidence is available to determine the relationship between maternal dietary patterns or cow milk products, eggs, peanuts, soybean, wheat, fish, tree nuts and seeds, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during lactation and risk of food allergy in the child. (Grade: Grade not assignable)

Atopic dermatitis/eczema

Pregnancy

- Moderate evidence indicates that lower or restricted consumption of cow milk products during pregnancy does not reduce the risk of atopic dermatitis/eczema in the child. (Grade: Moderate)
- Moderate evidence indicates that lower or restricted consumption of egg during pregnancy does not reduce the risk of atopic dermatitis/eczema in the child. (Grade:

Moderate)
- Insufficient evidence is available to determine the relationship between cow milk products and eggs restricted during both pregnancy and lactation and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)
- Limited evidence suggests that fish consumed during pregnancy does not increase the risk of atopic dermatitis/eczema in the child. (Grade: Limited)
- Limited evidence suggests that dietary patterns during pregnancy are not associated with risk of atopic dermatitis/eczema in the child. (Grade: Limited)
- Insufficient evidence is available to determine the relationship between peanuts, soybean, wheat/cereal, yogurt and probiotic milk products, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits, consumed during pregnancy and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)
- No evidence is available to determine the relationship between tree nuts and seeds consumed during pregnancy and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)

Lactation

- Insufficient evidence is available to determine the relationship between cow milk products restricted during both pregnancy and lactation, or during lactation only, and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)
- Insufficient evidence is available to determine the relationship between egg consumption restricted during both pregnancy and lactation and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)
- No evidence is available to determine the relationship between maternal dietary patterns or yogurt and probiotic milk products, eggs, fish, peanuts, tree nuts and seeds, soybean, wheat/cereal, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits, consumed during lactation and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)

Allergic rhinitis

Pregnancy

- Insufficient evidence is available to determine the relationship between cow milk products (fermented or non-fermented) consumed during pregnancy only, or during both pregnancy and lactation, and risk of allergic rhinitis in the child. (Grade: Grade not assignable)
- Moderate evidence indicates that lower or restricted consumption of eggs during pregnancy does not reduce the risk of allergic rhinitis in the child. (Grade: Moderate)
- Limited evidence suggests that dietary patterns during pregnancy are not associated with risk of allergic rhinitis in the child. (Grade: Limited)
- Insufficient evidence is available to determine the relationship between fish, peanuts, tree nuts, soybean, wheat, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during pregnancy and risk of allergic rhinitis in the child. (Grade: Grade not assignable)
- No evidence is available to determine the relationship between seeds consumed during pregnancy and the risk of allergic rhinitis in the child. (Grade: Grade not

assignable)

Lactation

- Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation, and risk of allergic rhinitis in the child. (Grade: Grade not assignable)
- No evidence is available to determine the relationship between maternal dietary patterns or cow milk products, eggs, fish, peanuts, tree nuts and seeds, soybean, wheat, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during lactation and risk of allergic rhinitis in the child. (Grade: Grade not assignable)

Asthma

Pregnancy

- Limited evidence suggests that a lower consumption of cow milk products during pregnancy does not reduce risk of asthma in the child. (Grade: Limited)
- Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation and risk of asthma in the child. (Grade: Grade not assignable)
- Limited evidence suggests no relationship between eggs consumed during pregnancy and risk of asthma in the child. (Grade: Limited)
- Limited evidence suggests no relationship between fish consumed during pregnancy and risk of asthma in the child. (Grade: Limited)
- Insufficient evidence is available to determine the relationship between maternal dietary patterns or peanuts, tree nuts, soybean, and other foods such as wheat/whole grains, vegetables, fruits, beverages, and margarine consumed during pregnancy and risk of asthma in the child. (Grade: Grade not assignable)
- No evidence is available to determine the relationship between seeds consumed during pregnancy and risk of asthma in the child. (Grade: Grade not assignable)

Lactation

- Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation, or during lactation only, and risk of asthma in the child. (Grade: Grade not assignable)
- Insufficient evidence is available to determine the relationship between fish, and other foods, such as margarine, oil, butter and butter-spreads, meat, and meat products consumed during lactation and risk of asthma in the child. (Grade: Grade not assignable)
- No evidence is available to determine the relationship between maternal dietary patterns or eggs, peanuts, wheat, tree nuts and seeds, and soybean consumed during lactation and risk of asthma in the child. (Grade: Grade not assignable)

Methods

- A literature search was conducted using four databases (PubMed, Cochrane, Embase, and CINAHL) to identify articles that evaluated the intervention or exposure of maternal diet during pregnancy and lactation and the outcomes of child food allergies and atopic allergic diseases. A manual search was conducted to

identify articles that may not have been included in the electronic databases searched. Articles were screened by two NESR analysts independently for inclusion based on pre-determined criteria.

- Data extraction and risk of bias assessment were conducted for each included study, and both were checked for accuracy. The Committee qualitatively synthesized the body of evidence to inform development of a conclusion statement(s), and graded the strength of evidence using pre-established criteria for risk of bias, consistency, directness, precision, and generalizability.

Summary of the evidence

Pregnancy[iii]

- This systematic review included 36 articles from five randomized controlled trials (RCTs), one non-RCT (NRCT), and 13 prospective cohort studies that assessed the association between maternal diet and risk of food allergy, atopic dermatitis/eczema, allergic rhinitis, and asthma in the child occurring from birth through 18 y of age. The articles were published between 1987 and 2020 and consisted of:
    - Thirty articles from 15 studies that included only pregnant women.
    - Six articles from four studies that included both pregnant and lactating women.
- Six articles from two RCTs and two prospective cohort studies examined maternal avoidance and/or consumption of cow milk products, eggs, soybean, wheat, and peanuts during pregnancy alone, or during both pregnancy and lactation, in relation to risk of food allergy in the child from birth through 18 y of age.
- Twenty-five articles from five RCTs, one NRCT, and 10 prospective cohort studies examined maternal dietary patterns and consumption and/or avoidance of cow milk products, eggs, fish, soybean, wheat, peanuts, tree nuts, and other foods not commonly considered to be allergens during pregnancy alone, or during both pregnancy and lactation, in relation to risk of atopic dermatitis/eczema in the child from birth through age 18 y.
- Sixteen articles from four RCTs and six prospective cohort studies examined maternal dietary patterns and avoidance and/or consumption of cow milk products, eggs, fish, soybean, wheat, peanuts, tree nuts, and other foods not commonly considered to be allergens during pregnancy alone, or during both pregnancy and lactation, in relation to risk of allergic rhinitis in the child from birth through 18 y of age.
- Nineteen articles from two RCTs and eight prospective cohort studies examined maternal dietary patterns and avoidance and/or consumption of cow milk products, eggs, fish, soybean, peanuts, tree nuts, and other foods during pregnancy alone, or during both pregnancy and lactation, in relation to risk of asthma in the child from 2 through 18 y of age.
- No articles were identified that examined maternal consumption of seeds during pregnancy in relation to risk of atopic outcomes in the child from birth through 18 y of age.
- The ability to draw strong conclusions was limited by the following issues:
    - Few RCTs have been conducted and thus, data were primarily observational in nature, limiting the ability to determine causal effects of consumption or avoidance of different foods during pregnancy and risk of

atopic dermatitis, food allergies, allergic rhinitis, and asthma in the child.
    - Key confounders were not consistently controlled for in most of the studies.
    - Studies had risk-of-bias issues, such as self-reported outcomes and selection bias.
    - People with lower SES, adolescents, and racially and ethnically diverse populations were underrepresented in the body of evidence.

Lactation[iii]

- This systematic review included eight articles from four randomized controlled trials (RCTs), one non-RCT (NRCT), and one prospective cohort study that assessed the relationship between maternal diet during both pregnancy and lactation, or during lactation alone, and risk of food allergy, atopic dermatitis/eczema, allergic rhinitis, and asthma in the child occurring from birth through 18 y of age. The included articles were published between 1989 and 2013.
    - Six articles from four studies included both pregnant and lactating women.
    - Two studies included only lactating women.
- Four articles from two RCTs examined maternal avoidance of cow milk products, eggs, soybean, wheat, and peanuts during both pregnancy and lactation, in relation to risk of food allergy and allergic rhinitis in the child from birth through 18 y of age. None of these studies were conducted exclusively in lactating women.
- Seven articles from four RCTs and one NRCT examined maternal avoidance of cow milk products, eggs, soybean, wheat, and peanuts during both pregnancy and lactation, or during lactation alone, in relation to the risk of atopic dermatitis/eczema in the child from birth through 18 y of age. Of these, only one RCT was conducted exclusively in lactating women.
- Four articles from two RCTs and one prospective cohort study examined maternal avoidance and/or consumption of cow milk products, eggs, fish, soybean, peanuts, wheat, and other foods during both pregnancy and lactation, or during lactation alone, in relation to risk of asthma in the child from 2 through 18 y of age. Of these, one prospective cohort study was conducted exclusively in lactating women.
- No articles were identified that examined maternal avoidance or consumption of seeds during lactation in relation to the risk of atopic outcomes in the child from birth through 18 y of age.
- The ability to draw strong conclusions was limited by the following issues:
    - Very few studies assessed the relationship between maternal diet during lactation alone and risk of atopic dermatitis, food allergy, allergic rhinitis, and asthma.
    - Key confounders were not consistently controlled for in most of the studies.
    - Women with lower socioeconomic status (SES), adolescents, and racially and ethnically diverse populations were underrepresented in the body of evidence.

[iii] Studies with interventions during both pregnancy and lactation are discussed in both pregnancy and lactation sections

FULL REVIEW

Systematic review question

What is the relationship between maternal diet during pregnancy and lactation and risk of child food allergies and atopic allergic diseases?

Conclusion statements and grades

Food allergy

Pregnancy

Insufficient evidence is available to determine the relationship between lower or restricted consumption of cow milk products during pregnancy only, or during both pregnancy and lactation, and risk of food allergy in the child. (Grade: Grade not assignable)

Insufficient evidence is available to determine the relationship between peanuts, eggs, or wheat consumed during pregnancy and risk of food allergy in the child. (Grade: Grade not assignable)

Limited evidence suggests no relationship between soybean consumed during pregnancy and risk of food allergy in the child. (Grade: Limited)

No evidence is available to determine the relationship between maternal dietary patterns or fish, tree nuts and seeds, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during pregnancy and risk of food allergy in the child. (Grade: Grade not assignable)

Lactation

Insufficient evidence is available to determine the relationship between lower or restricted consumption of cow milk products during both pregnancy and lactation and risk of food allergy in the child. (Grade: Grade not assignable)

No evidence is available to determine the relationship between maternal dietary patterns or cow milk products, eggs, peanuts, soybean, wheat, fish, tree nuts and seeds, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during lactation and risk of food allergy in the child. (Grade: Grade not assignable)

Atopic dermatitis/eczema

Pregnancy

Moderate evidence indicates that lower or restricted consumption of cow milk products during pregnancy does not reduce the risk of atopic dermatitis/eczema in the child. (Grade: Moderate)

Moderate evidence indicates that lower or restricted consumption of egg during pregnancy does not reduce the risk of atopic dermatitis/eczema in the child. (Grade: Moderate)

Insufficient evidence is available to determine the relationship between cow milk products and eggs restricted during both pregnancy and lactation and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)

Limited evidence suggests that fish consumed during pregnancy does not increase the risk of atopic dermatitis/eczema in the child. (Grade: Limited)

Limited evidence suggests that dietary patterns during pregnancy are not associated with risk of atopic dermatitis/eczema in the child. (Grade: Limited)

Insufficient evidence is available to determine the relationship between peanuts, soybean, wheat/cereal, yogurt and probiotic milk products, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits, consumed during pregnancy and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)

No evidence is available to determine the relationship between tree nuts and seeds consumed during pregnancy and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)

Lactation

Insufficient evidence is available to determine the relationship between cow milk products restricted during both pregnancy and lactation, or during lactation only, and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)

Insufficient evidence is available to determine the relationship between egg consumption restricted during both pregnancy and lactation and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)

No evidence is available to determine the relationship between maternal dietary patterns or yogurt and probiotic milk products, eggs, fish, peanuts, tree nuts and seeds, soybean, wheat/cereal, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits, consumed during lactation and risk of atopic dermatitis/eczema in the child. (Grade: Grade not assignable)

Allergic rhinitis

Pregnancy

Insufficient evidence is available to determine the relationship between cow milk products (fermented or non-fermented) consumed during pregnancy only, or during both pregnancy and lactation, and risk of allergic rhinitis in the child. (Grade: Grade not assignable)

Moderate evidence indicates that lower or restricted consumption of eggs during pregnancy does not reduce the risk of allergic rhinitis in the child. (Grade: Moderate)

Limited evidence suggests that dietary patterns during pregnancy are not associated with risk of allergic rhinitis in the child. (Grade: Limited)

Insufficient evidence is available to determine the relationship between fish, peanuts, tree nuts, soybean, wheat, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during pregnancy and risk of allergic rhinitis in the child. (Grade: Grade not assignable)

No evidence is available to determine the relationship between seeds consumed during pregnancy and the risk of allergic rhinitis in the child. (Grade: Grade not assignable)

Lactation

Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation, and risk of allergic rhinitis in the child. (Grade: Grade not assignable)

No evidence is available to determine the relationship between maternal dietary patterns or cow milk products, eggs, fish, peanuts, tree nuts and seeds, soybean, wheat, and foods not commonly considered to be allergens, such as meat, vegetables, and fruits consumed during lactation and risk of allergic rhinitis in the child. (Grade: Grade not assignable)

Asthma

Pregnancy

Limited evidence suggests that a lower consumption of cow milk products during pregnancy does not reduce risk of asthma in the child. (Grade: Limited)

Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation and risk of asthma in the child. (Grade: Grade not assignable)

Limited evidence suggests no relationship between eggs consumed during pregnancy and risk of asthma in the child. (Grade: Limited)

Limited evidence suggests no relationship between fish consumed during pregnancy and risk of asthma in the child. (Grade: Limited)

Insufficient evidence is available to determine the relationship between maternal dietary patterns or peanuts, tree nuts, soybean, and other foods such as wheat/whole grains, vegetables, fruits, beverages, and margarine consumed during pregnancy and risk of asthma in the child. (Grade: Grade not assignable)

No evidence is available to determine the relationship between seeds consumed during pregnancy and risk of asthma in the child. (Grade: Grade not assignable)

Lactation

Insufficient evidence is available to determine the relationship between cow milk products consumed during both pregnancy and lactation, or during lactation only, and risk of asthma in the child. (Grade: Grade not assignable)

Insufficient evidence is available to determine the relationship between fish, and other foods, such as margarine, oil, butter and butter-spreads, meat, and meat products consumed during lactation and risk of asthma in the child. (Grade: Grade not assignable)

No evidence is available to determine the relationship between maternal dietary patterns or eggs, peanuts, wheat, tree nuts and seeds, and soybean consumed during lactation and risk of asthma in the child. (Grade: Grade not assignable)

Summary of the evidence

Pregnancy[iv]

- This systematic review included 36 articles from five randomized controlled trials (RCTs), one non-RCT (NRCT), and 13 prospective cohort studies that assessed the association between maternal diet and risk of food allergy, atopic dermatitis/eczema, allergic rhinitis, and asthma in the child occurring from birth through 18 years of age. The articles were published between 1987 and 2020 and consisted of:
    - Thirty articles from 15 studies that included only pregnant women.
    - Six articles from four studies that included both pregnant and lactating women.
- Six articles from two RCTs and two prospective cohort studies examined maternal avoidance and/or consumption of cow milk products, eggs, soybean, wheat, and peanuts during pregnancy alone, or during both pregnancy and lactation, in relation to risk of food allergy in the child from birth through 18 y of age.
- Twenty-five articles from five RCTs, one NRCT, and 10 prospective cohort studies examined maternal dietary patterns and consumption and/or avoidance of cow milk products, eggs, fish, soybean, wheat, peanuts, tree nuts, and other foods not commonly considered to be allergens during pregnancy alone, or during both pregnancy and lactation, in relation to risk of atopic dermatitis/eczema in the child from birth through age 18 years.
- Sixteen articles from four RCTs and six prospective cohort studies examined maternal dietary patterns and avoidance and/or consumption of cow milk products, eggs, fish, soybean, wheat, peanuts, tree nuts, and other foods not commonly considered to be allergens during pregnancy alone, or during both pregnancy and lactation, in relation to risk of allergic rhinitis in the child from birth through 18 y of age.
- Nineteen articles from two RCTs and eight prospective cohort studies examined maternal dietary patterns and avoidance and/or consumption of cow milk products, eggs, fish, soybean, peanuts, tree nuts, and other foods during pregnancy alone, or during both pregnancy and lactation, in relation to risk of asthma in the child from 2 through 18 y of age.
- No articles were identified that examined maternal consumption of seeds during pregnancy in relation to risk of atopic outcomes in the child from birth through 18 y of age.
- The ability to draw strong conclusions was limited by the following issues:
    - Few RCTs have been conducted and thus, data were primarily observational in nature, limiting the ability to determine causal effects of consumption or avoidance of different foods during pregnancy and risk of atopic dermatitis, food allergies, allergic rhinitis, and asthma in the child.
    - Key confounders were not consistently controlled for in most of the studies.
    - Studies had risk-of-bias issues, such as self-reported outcomes and selection bias.
    - People with lower SES, adolescents, and racially and ethnically diverse populations were underrepresented in the body of evidence.

Lactation[iv]

- This systematic review included eight articles from four randomized controlled trials (RCTs), one non-RCT (NRCT), and one prospective cohort study that assessed the relationship between maternal diet during both pregnancy and lactation, or during lactation alone, and risk of food allergy, atopic dermatitis/eczema, allergic rhinitis, and asthma in the child occurring from birth through 18 years of age. The included articles were published between 1989 and 2013.
    - Six articles from four studies included both pregnant and lactating women.
    - Two studies included only lactating women.
- Four articles from two RCTs examined maternal avoidance of cow milk products, eggs, soybean, wheat, and peanuts during both pregnancy and lactation, in relation to risk of food allergy and allergic rhinitis in the child from birth through 18 y of age. None of these studies were conducted exclusively in lactating women.
- Seven articles from four RCTs and one NRCT examined maternal avoidance of cow milk products, eggs, soybean, wheat, and peanuts during both pregnancy and lactation, or during lactation alone, in relation to the risk of atopic dermatitis/eczema in the child from birth through 18 years of age. Of these, only one RCT was conducted exclusively in lactating women.
- Four articles from two RCTs and one prospective cohort study examined maternal avoidance and/or consumption of cow milk products, eggs, fish, soybean, peanuts, wheat, and other foods during both pregnancy and lactation, or during lactation alone, in relation to risk of asthma in the child from 2 through 18 y of age. Of these, one prospective cohort study was conducted exclusively in lactating women.
- No articles were identified that examined maternal avoidance or consumption of seeds during lactation in relation to the risk of atopic outcomes in the child from birth through 18 y of age.
- The ability to draw strong conclusions was limited by the following issues:
    - Very few studies assessed the relationship between maternal diet during lactation alone and risk of atopic dermatitis, food allergy, allergic rhinitis, and asthma.
    - Key confounders were not consistently controlled for in most of the studies.
    - Women with lower socioeconomic status (SES), adolescents, and racially and ethnically diverse populations were underrepresented in the body of evidence.

[iv] Studies with interventions during both pregnancy and lactation are discussed in both pregnancy and lactation sections

Description of the evidence

This systematic review included articles that addressed the relationship between maternal diet during pregnancy and lactation and risk of child food allergies and atopic diseases. The search included articles from very high and high Human Development Index (HDI)[v] countries and the search timeframe spanned from January 1980 to January 2020. The following study designs were included: RCTs, NRCTs, prospective and retrospective cohort studies, and nested case-control studies.

The outcomes considered in this review were food allergies, atopic dermatitis, allergic rhinitis, and asthma in the child (birth to 18 years). Food allergy was defined as a diagnosis based on either the gold standard of a double-blind, placebo-controlled oral food challenge or as parental report of clinical history with blood immunoglobulin E (IgE) levels ≥ 0.35 kU/L and/or skin prick test wheal ≥ 3 mm. Because of the difficulty in diagnosing asthma during infancy and toddlerhood, only those studies that assessed asthma in children who were at least 2 years or older were included in this systematic review.

In total, 38 articles were included in the body of evidence. The evidence in this review is presented based on the outcomes: 1) Food allergy; 2) Atopic dermatitis/eczema; 3) Allergic rhinitis; and 4) Asthma.

Food Allergy

Six articles assessed the relationship between maternal diet and risk of food allergy in the child, including one from a Japanese RCT,[8] three from a U.S.-based RCT,[34-36] and one each from two prospective cohort studies.[4,12] A total of four distinct groups of trials/cohort studies were represented in this body of evidence. References are included for each study in **Table 1** with trial/cohort names or locations when names were unavailable.

One RCT[34-36] and one prospective cohort study[4] were conducted in the U.S. One study each was conducted in Japan[8] and the U.K.[12]

Participant characteristics

- Sample size of the studies ranged from 350[8] to 13,971.[12]
- Among the studies that reported these characteristics, all included participants were adult women with singleton pregnancies.
- Health characteristics:
    - RCTs recruited participants who exclusively[34-36] or predominantly[8] had a personal and/or family history of allergies.
    - In the prospective cohort studies,[4,12] participants represented the general

[v] The Human Development classification was based on the Human Development Index (HDI) ranking from the year the study intervention occurred or data were collected (UN Development Program. HDI 1990-2017 HDRO calculations based on data from UNDESA (2017a), UNESCO Institute for Statistics (2018), United Nations Statistics Division (2018b), World Bank (2018b), Barro and Lee (2016) and IMF (2018). Available from: http://hdr.undp.org/en/data). If the study did not report the year in which the intervention occurred or data were collected, the HDI classification for the year of publication was applied. HDI values are available from 1980, and then from 1990 to present. If a study was conducted prior to 1990, the HDI classification from 1990 was applied. When a country was not included in the HDI ranking, the current country classification from the World Bank was used instead (The World Bank. World Bank country and lending groups. Available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world- country-and-lending-groups).

population and the majority were not from families with high risk of allergies.

- Race/ethnicity:
  - The U.S.-based RCT[34-36] and Project Viva cohort study[4] noted that the participants were predominantly White (defined as ≥ 50 percent of the participants). One RCT included participants that were 100 percent from Japan.[8]
  - One prospective cohort study did not report race/ethnicity of participants.[12]
- Socio-economic status:
  - Maternal education:
    - One U.S.-based RCT[34-36] and prospective cohort study[4] reported that the majority of participants had some higher education.
    - One RCT[8] and one cohort study[12] did not report on maternal education.
  - Income/Employment Status:
    - The majority of women were employed and/or from middle-to-high income households in a U.S.-based trial[34-36] and Project Viva cohort study[4] that reported household income and/or participant employment status.
    - One RCT[8] and one cohort study[12] did not report on income or employment status.

Atopic dermatitis/eczema

Twenty six articles, including eight from six RCTs,[7,8,14,16,34-37] one NRCT,[10] and 17 from 10 prospective cohort studies[1,3-5,11,13,15,16,21-29,31] assessed the association between maternal diet and risk of atopic dermatitis. A total of 18 distinct groups of trials/cohort studies were represented in this body of evidence. References are included for each study in **Table 1** with trial/cohort names or locations when names were unavailable.

One RCT[8] and two prospective cohort studies were conducted in Japan.[21-26,28] In addition, three studies were conducted in the U.K.,[1,16,29,31] and two studies each in Sweden[7,14] and the U.S.,[4,34-36] and one each in the Netherlands,[13,27] Norway,[3] Germany,[10] Singapore,[15] Thailand,[37] Spain/Greece,[5] and Poland/U.S.[11]

Participant characteristics

- Sample size of the studies ranged from 44[16] to 40,641.[3]
- From the studies that reported these characteristics, almost all included participants who were adult women with singleton pregnancies.
  - Bédard et al[1] reported ~2.5 percent twin pregnancies in the ALSPAC cohort, Falth-Magnusson et al[7] and Lovegrove et al[16] each included one pair of twins in the trial, and Lilja et al[14] included four pairs of twins.
- Health characteristics:
  - The NRCT[10] and all the RCTs recruited participants who exclusively[7,14,16,34-37] or predominantly[8] had a personal and/or family history of allergies.

    - In the prospective cohort studies,[1,3-5,11,13,15,16,21-29,31] participants represented the general population and the majority were not from families with high risk of allergies.
- Race/ethnicity:
    - The U.S.-based RCT[34-36] and Project Viva cohort,[4] as well as the U.K.-based ALSPAC cohort,[1,29] noted that the participants were predominantly White (defined as ≥50 percent of the participants). The Growing Up in Singapore Towards Healthy Outcomes (GUSTO) cohort based in Singapore reported that all of its participants were of Asian race.[15] One RCT[8] and two prospective cohort studies[21-26,28] included participants that were 100 percent from Japan, while one article from the Generation R cohort specified that participants were Dutch women.[13]
    - Four RCTs,[7,14,16,37] the NRCT,[10] and four cohort articles did not report race/ethnicity of the mothers.[3,5,11,27,31]
- Socio-economic status:
    - Maternal education:
        - One U.S.-based RCT,[34-36] the NRCT,[10] and seven prospective cohort studies[1,4,11,13,15,21-27,29] reported that the majority of participants had some higher education. The study based in Greece and Spain reported that ~34 percent of participants had a high educational level,[5] while participants in one U.K.-based cohort were a median age of 18.5 years when they left full-time education.[31]
        - Five RCTs[7,8,14,16,37] did not report maternal education.
    - Income/Employment Status:
        - The majority of women were employed and/or from middle-to-high income households in one U.S.-based RCT[34-36] and four prospective cohort studies.[4,13,21-28,31]
        - About 17 percent of participants in one ALSPAC cohort article[1] responded yes to experiencing financial difficulties, while ~26 percent of participants in a second ALSPAC cohort article reported many financial difficulties.[29]
        - Five RCTs,[7,8,14,16,37] the NRCT,[10] and four cohorts[3,5,11,15] did not report income or employment status.

Allergic rhinitis

Sixteen articles, including six from four RCTs[7,8,14,34-36] and 10 from six prospective cohort studies,[1,3,4,15,17-20,29,31] assessed the association between maternal diet and risk of allergic rhinitis in the child . A total of 10 distinct groups of trials/cohort studies were represented in this body of evidence. References are included for each study in **Table 1** with trial/cohort names or locations when names were unavailable. One RCT[34-36] and one prospective cohort study[4] were conducted in the U.S., while one prospective cohort study was conducted in Denmark.[17-20] Two studies were conducted in Sweden,[7,14] while two cohort studies were conducted in the U.K.[1,29,31] One study each was conducted in Singapore,[15] Norway,[3] and Japan.[8]

Participant characteristics

- Sample size of the studies ranged from 171[14] to 61,909.[18]

- From the studies that reported these characteristics, almost all included participants who were adult women with singleton pregnancies.
    - ~1 percent of participants were younger than 20 years in the Danish National Birth Cohort.[17-20]
    - Bédard et al[1] reported ~2.5 percent twin pregnancies in the ALSPAC cohort, Falth-Magnusson et al[7] included one pair of twins in the trial, and Lilja et al[14] included four pairs of twins.
- Health characteristics:
    - RCTs recruited participants who exclusively[7,14,34-36] or predominantly[8] had a personal and/or family history of allergies.
    - In the prospective cohort studies,[1,3,4,15,17-20,29,31] participants represented the general population and the majority were not from families with high risk of allergies.
- Race/ethnicity:
    - The U.S.-based RCT[34-36] and Project Viva cohort study,[4] as well as the U.K.-based ALSPAC cohort,[1,29] noted that the participants were predominantly White (defined as ≥50 percent of the participants). The GUSTO cohort based in Singapore reported that all of its participants were of Asian race.[15] One RCT included participants that were 100 percent from Japan.[8]
    - Two RCTs[7,14] and three prospective cohort studies[3,17-20,31] did not report race/ethnicity of participants.
- Socio-economic status:
    - <u>Maternal education:</u>
        - One U.S.-based RCT[34-36] and four prospective cohort studies[1,3,4,15,29] reported that the majority of participants had some higher education. Participants in one U.K.-based cohort were a median age of 18.5 years when they left full-time education.[31]
        - Three RCTs[7,8,14] and one Danish cohort did not report on maternal education.[17-20]
    - <u>Income/Employment Status:</u>
        - The majority of women were employed and/or from middle-to-high income households in one U.S.-based RCT[34-36] and the Project Viva cohort,[4] one U.K.-based cohort,[31] and the Danish National Birth Cohort.[17-20]
        - About 17 percent of participants in one ALSPAC cohort report[1] responded yes to experiencing financial difficulties, while ~26 percent of participants in a second ALSPAC cohort report indicated many financial difficulties.[29]
        - Three RCTs[7,8,14] and two cohorts[3,15] did not report on income or employment status.

Asthma

Twenty articles, including three from two RCTs[8,34,36] and 17 from nine prospective cohort studies,[1-4,6,9,17-20,27,29-33,38] assessed the association between maternal diet and risk of asthma in the child. A total of 11 distinct groups of trials/cohort studies were represented in this body of evidence. References are included for each study in **Table 1** with trial/cohort names or locations when names were unavailable.

One RCT[34,36] and one prospective cohort study[4,9,33] were conducted in the U.S. One prospective cohort study was conducted in Denmark,[17-20] while two cohort studies were conducted in the U.K.[1,2,29,31] One cohort study was conducted in Ireland,[6,30] while two cohort studies were conducted in the Netherlands.[27,32] One study each was conducted in Norway,[3] Finland,[38] and Japan.[8]

Participant characteristics:

- Sample size of the studies ranged from 350[8] to 61,909.[18]
- Among the studies that reported these characteristics, majority of included participants were adult women with singleton pregnancies.
    - About 1 percent of participants were younger than 20 years in the Danish National Birth Cohort,[17-20] while ~2 percent of participants were younger than 18 years in an Irish cohort.[6,30]
    - Bédard et al[1,2] reported ~2.5 percent twin pregnancies in the ASLPAC cohort.
- Health characteristics:
    - RCTs recruited participants who exclusively[34,36] or predominantly[8] had a personal and/or family history of allergies.
    - In the prospective cohort studies,[1-4,6,9,17-20,27,29-33,38] participants represented the general population and the majority were not from families with high risk of allergies.
- Race/ethnicity:
    - The U.S.-based RCT[34,36] and Project Viva cohort study,[4,9,33] as well as the U.K.-based ALSPAC cohort,[1,2,29] noted that the participants were predominantly White (defined as ≥ 50 percent of the participants). Participants in the Lifeways Cross-Generation cohort study were 100 percent Irish-born.[6,30] One RCT included participants that were 100 percent from Japan.[8]
    - Seven prospective cohort studies did not report race/ethnicity of participants.[3,17-20,27,31,32,38]
- Socio-economic status:
    - <u>Maternal education:</u>
        - One U.S.-based RCT[34,36] and six prospective cohort studies[1-4,6,9,27,29,30,33] reported that the majority of participants had some higher education. Participants in one U.K.-based cohort were a median age of 18.5 years, when they left full-time education,[31] while a cohort based in the Netherlands reported that ~34 percent of participants had a high educational level at baseline.[32]
        - One RCT[8] and two cohort studies did not report maternal education level.[17-20,38]
    - <u>Income/Employment Status:</u>
        - The majority of women were employed and/or from middle-to-high income households in one U.S.-based RCT[34,36] and the Project Viva cohort,[4,9,33] one U.K.-based cohort,[31] the Generation R cohort,[27] and the Danish National Birth Cohort.[17-20]
        - About 17 percent of participants in two ALSPAC cohort responded yes to experiencing financial difficulties,[1,2] while ~26 percent of participants in a third ALSPAC cohort indicated many financial

difficulties.[29] About 16 percent of participants were eligible for free healthcare in the Lifeways Cross-Generation cohort study.[6,30]

- One RCT[8] and three cohorts[3,32,38] did not report on income or employment status.

Table 1. Included trials and cohorts

Trial/Cohort name	Outcome(s)	References
Randomized Controlled Trials		
Linköping (Sweden)	Atopic dermatitis/eczema Allergic rhinitis	7
Tokyo (Japan)	Atopic dermatitis/eczema Food allergy Allergic rhinitis Asthma	8
Stockholm and Uppsala (Sweden)	Atopic dermatitis/eczema Allergic rhinitis	14
Guildford (U.K.)	Atopic dermatitis/eczema	16
Bangkok (Thailand)	Atopic dermatitis/eczema	37
San Diego (U.S.)	Atopic dermatitis/eczema Food allergy Allergic rhinitis Asthma	34-36
Non-Randomized Controlled Trials		
Berlin (Germany)	Atopic dermatitis/eczema	10
Prospective Cohort Studies		
Osaka Maternal and Child Health Study (OMCHS)	Atopic dermatitis/eczema	21-24,28
Kyushu Okinawa Maternal and Child Health Study (KOMCHS)	Atopic dermatitis/eczema	25,26
Rhea & INfancia y Medio Ambiente (INMA)	Atopic dermatitis/eczema	5
Generation R Study	Atopic dermatitis/eczema Asthma	13,27
Growing Up in Singapore Towards Healthy Outcomes (GUSTO)	Atopic dermatitis/eczema Allergic rhinitis	15

Trial/Cohort name	Outcome(s)	References
Avon Longitudinal Study of Parents and Children (ALSPAC)	Atopic dermatitis/eczema Food allergy Allergic rhinitis Asthma	1,2,12,29
Norwegian Mother and Child Cohort Study (MoBa)	Atopic dermatitis/eczema Allergic rhinitis Asthma	3
Project Viva	Atopic dermatitis/eczema Food allergy Allergic rhinitis Asthma	4,9,33
Danish National Birth Cohort (DNBC)	Allergic rhinitis Asthma	17-20
Lifeways Cross-Generation Cohort Study	Asthma	6,30
Type 1 Diabetes Prediction and Prevention (DIPP) Project	Asthma	38
Prevention and Incidence of Asthma and Mite Allergy (PIAMA)	Asthma	32
New York City (U.S.) and Krakow (Poland)	Atopic dermatitis/eczema	11
Aberdeen (U.K.)	Atopic dermatitis/eczema Allergic rhinitis Asthma	31

Interventions/Exposures

The intervention/exposure for this review was intentionally broad and included foods or food groups that may or may not be considered allergens. This review, however, did not assess the relationship between specific nutrients or dietary supplements and allergies and atopic allergic diseases. Studies included in this body of evidence assessed maternal diet during pregnancy and/or lactation in three main ways:

Avoidance diet

Six RCTs[7,8,14,16,34-37] and one NRCT[10] focused on maternal avoidance of specific foods/food groups including:

- Cow milk products[8,16,37]
- Cow milk products and egg[7,10,14]
- Cow milk products, egg, peanut, soy, and wheat[34-36]

Dietary patterns

Dietary patterns (DP) were assessed using an 1) index/score analysis or a 2) factor analysis and principal component analysis. A description of the studies categorized by the method used to measure dietary patterns is included below:

- Five articles representing four cohorts used the following indices/scores summarized below:
    - Mediterranean DP[5]
    - Diet quality score[27]
    - Mediterranean diet score[1]
    - Dietary Inflammatory Index (DII)[9]
    - Healthy Eating Index (HEI)[6]
- Three articles assessed dietary patterns using factor analysis or principal component analysis:
    - Healthy DP, Western DP, and Japanese DP[21]
    - Vegetable, fruit and white rice DP, Seafood and noodles DP, Pasta, cheese and processed meat DP[15]
    - Health conscious DP, Traditional DP, Processed DP, Vegetarian DP and Confectionary DP[29]

Food/beverage consumption levels

Twenty-two articles from 13 cohort studies compared the association between different consumption levels of a variety of different foods and beverages and risk of atopic outcomes, including:

- Dairy products[4,5,18,22,26,28,32,38]
    - Yogurt and fermented milk products[3,18,22,26,28,32]
- Peanuts[4,17]
- Nuts[5,17,32]
- Wheat/cereals[4,5,31]
- Fish[5,11,13,19,24,25,28,30-32,38]
- Eggs[4,32]
- Soybean[4,12]
- Foods not commonly considered to be allergens (as reported by the studies)
    - Fruits[2,5,23,31,32]
    - Vegetables[2,5,23,30-32]
    - Sugar-sweetened beverages[20,33]
    - Artificially-sweetened soft drinks[20]
    - Margarine/oil/fats[31,38]
    - Meat[5,24,25,28,38]

Time point of intervention/exposure

The RCTs and NRCT began the avoidance diets at different time points:

- Early third trimester through the end of pregnancy[7,14] or through early

lactation[34-36]

- Late third trimester through early lactation[8,10,16]
- After delivery through early lactation[37]

Most of the cohort studies administered a food frequency questionnaire (FFQ) or 24h recall at a single time point during pregnancy.[1-3,5,6,11-13,15,17-32] In the Project Viva cohort, dietary data were collected at multiple time points during pregnancy and assessed at individual time points (e.g. by trimester) or combined in the analysis.[4,9,33] In one cohort study, maternal dietary data were collected at a single time point during lactation by a FFQ.[38]

Outcome

Food allergy was defined as a diagnosis based on either the gold standard of a double-blind, placebo-controlled oral food challenge,[12] or as parental report of clinical history together with blood IgE levels ≥0.35 kU/L and/or skin prick test wheal ≥3 mm.[4,8,12,34-36] Studies that reported food sensitization only, based solely on IgE levels or a skin prick test, were excluded.

Atopic dermatitis/eczema, allergic rhinitis, and asthma outcomes in this body of evidence were measured in three ways:

- Self-reported symptoms, prescription, or doctor diagnosis via a questionnaire[1-5,8,9,13,15,17-29,31-33,38]
- Clinical examination[6,7,10,14,16,30,34-37]
- Hospital admission and prescription registries[17-20]

Because of the difficulty in diagnosing asthma during infancy and toddlerhood, only those studies that assessed asthma in children who were at least 2 years or older were included in this systematic review.

Evidence synthesis – Food allergy

With six articles,[4,8,12,34-36] there is a smaller body of evidence available to examine the relationship between maternal diet during pregnancy and lactation and food allergies in the child.

Cow milk products

Pregnancy: A U.S.-based cohort study[4] showed no association between maternal consumption of milk during pregnancy in the first and second trimesters and risk of food allergy in the child.

Pregnancy and lactation: A Japan-based RCT,[8] conducted in high-risk families, randomized mothers to consume hypoallergenic formula and avoid cow milk products during late pregnancy and lactation. Results showed no difference in the prevalence of overall allergies between children of the intervention and control group mothers and median blood IgE levels of infants did not differ between groups at 4 months of age.

Three additional articles from one U.S.-based trial[34-36] assessed the effect of a prophylactic treatment, which included avoidance of cow milk, egg, and peanut during the third trimester and while lactating, on development of atopy in children from high-risk families. In addition to the intervention in the mothers, infants in the intervention group also received an intervention, which included the following: a) casein

hydrolysate formula when supplementing human milk and during weaning, b) not started on solid food until 6 months of age, c) cow milk, corn, soy, citrus and wheat restriction until 12 months of age, and d) eggs, peanut, and fish restriction until 24 months of age. The mothers in the control group followed a standard diet during pregnancy and lactation their infants were supplemented with standard infant formula (Enfamil) during human milk feeding and weaning; solid foods were introduced to control group infants in accordance with standard guidance by the American Academy of Pediatrics. While the three articles from this RCT[34-36] met the inclusion criteria and findings are reported in **Table 2**, they were not considered in evidence synthesis, grading, or when drawing conclusions because of confounding from the additional child intervention. The trial also had limitations regarding risk of bias due to randomization, attrition rate (38 percent in intervention vs. 13 percent in control group; $p<0.001$), and non-blinding of the outcome assessors and participants.

Lactation: No studies assessed the relationship between maternal consumption of cow milk products during lactation and risk of food allergy in the child.

Egg

Pregnancy: A U.S.-based cohort study[4] showed no association between maternal consumption of eggs during the first and second trimesters and risk of food allergy in the child.

Pregnancy and lactation: As described above (p. 31), three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions.

Lactation: No studies assessed the relationship between maternal consumption of eggs during lactation and risk of food allergy in the child.

Peanut, tree nut and seed

Pregnancy: One prospective cohort study[4] conducted in the U.S. showed no association between maternal peanut consumption during the first and second trimesters and risk of food allergy in the child.

No study assessed the relationship between maternal tree nut and seed consumption during pregnancy and risk of food allergy in the child.

Pregnancy and lactation: Three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: No study assessed the relationship between maternal peanut, tree nut and seed consumption during lactation and risk of food allergy in the child.

Soy

Pregnancy: Two prospective cohort studies, one based in the U.S.[4] and another based in the U.K.,[12] showed no association between maternal soy consumption during pregnancy and risk of food allergy in the child. Note: The U.K. study assessed the association between maternal soybean meat consumption (data collected prospectively) during pregnancy and risk of peanut allergies diagnosed using a food challenge in the child. While the study also assessed the association between maternal peanut consumption and risk of peanut allergies in the child, this data was collected retrospectively and did not meet the inclusion-exclusion criteria.

Pregnancy and lactation: Three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: There were no studies that assessed the relationship between maternal soy consumption during lactation and risk of food allergy in the child.

Wheat

Pregnancy: A U.S.-based cohort study[4] showed no association between maternal wheat consumption during pregnancy in the first and second trimesters and risk of food allergy in the child.

Pregnancy and lactation: Three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: No studies assessed the relationship between maternal wheat consumption during lactation and risk of food allergy in the child.

Other foods

Pregnancy: No study assessed the relationship between maternal consumption of other foods not commonly considered to be allergens, during lactation and risk of food allergy in the child.

Assessment of the evidence[vi]

Soy

The following conclusion statement was supported by two cohort studies[4,12] and was graded "limited." The individual grading elements are discussed below.

"Limited evidence suggests no relationship between soybean consumed during pregnancy and risk of food allergy in the child."

As outlined and described below, the body of evidence examining soybean consumed during pregnancy and risk of food allergy in the child was assessed for the following elements used when grading the strength of evidence.

- **Risk of bias** (**Table 8**) was graded as limited as there were serious flaws in the design and conduct of the studies, which are described below:
    - At least one of the key confounders was not controlled for in the U.S.-based cohort study[4] and none of the key confounders were accounted for in the U.K.-based study.[12]
    - Dietary data reflected dietary intake at a single time point during pregnancy and may not have reflected the intake during the entire period of pregnancy. In the U.K. study, the exposure status (i.e., soybean meat) and methods used to assess exposure were not clearly defined. Further, the U.K. study did not assess the impact of consumption of a particular food with regard to the development of

[vi] A detailed description of the methodology used for grading the strength of the evidence is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews and in Part C of the following reference: Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

allergies to that particular food.
    - One study assessed outcomes using non-validated or unreliable measures (e.g., parent report of a child's symptoms or parent's report of a physician diagnosis).
    - None of the included studies had a pre-registered data analysis plan. Further, there was a likelihood of selective reporting in the U.K. study.
- **Consistency** was graded as strong since both studies consistently reported no association between soy consumption during pregnancy and risk of food allergy in the child.
- **Directness** was graded as limited. Although the U.K. study reported the association between maternal soybean meat consumption during pregnancy and risk of food allergy in the child, it was not the primary purpose of the study. While the U.S.-based study focused on addressing the systematic review question, these data were from a large cohort study (Project Viva) that addressed associations between different exposures and outcomes.
- **Precision** was graded as limited. Even though both studies had a moderate to large number of participants (11,352 participants[12] and approximately 600 participants[4]), there were only two cohort studies included in this body of evidence. However, neither of them unduly affected the findings of this systematic review.
- **Generalizability** was graded as limited. Although one of the studies was conducted in the U.S., the participants were predominantly White and were from mid-to-high SES. In the U.K.-based study, the authors provided minimal information on the race/ethnicity or other demographic characteristics.

Other foods

The bodies of evidence that assessed the relationship between:

- Lower or restricted consumption of cow milk products during pregnancy, or during pregnancy and lactation,
- Peanuts, eggs, or wheat consumed during pregnancy,

and risk of food allergy in the child were rated 'grade not assignable' for one or more of the following reasons:

- a very small body of evidence, usually less than two studies,
- heterogeneity in the findings,
- serious flaws in the design and conduct of the study, and
- limited generalizability of the findings to the U.S. population.

Evidence synthesis – Atopic dermatitis/eczema

With 26 articles,[1,3-5,7,8,10,11,13-16,21-29,31,34-37] there is a substantial body of evidence available to examine the relationship between maternal diet during pregnancy and/or lactation and atopic dermatitis/eczema in the child (**Table 3**).

Cow milk products

Pregnancy: Seven studies, including two RCTs[7,14] and five prospective

cohorts,[4,5,22,26,28] assessed the relationship between cow milk products consumed during pregnancy and risk of atopic dermatitis/eczema. The RCTs were specifically designed to assess the relationship between the avoidance of cow milk products during pregnancy and atopic dermatitis/eczema in the child, whereas the cohort studies assessed the association between consumption of cow milk products and atopic dermatitis/eczema. As mentioned elsewhere, the RCTs primarily recruited high-risk families and this was not the case with prospective cohort studies.

None of the studies showed an association between maternal cow milk product consumption and atopic dermatitis/eczema. The only exception was a sub-group analysis in a Project Viva cohort study[4] that showed that maternal milk consumption during the first trimester was associated with a lower risk of atopic dermatitis only among children whose parents had atopy. However, there was no association between second trimester cow milk consumption and atopic dermatitis risk in child, irrespective of parental atopy.

Pregnancy and lactation: The three articles[34-36] from a single U.S. trial met the inclusion criteria. The findings are presented in Table 3. However, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: One Thailand-based RCT[37] with 62 participants showed that infants born to the mothers who were randomized to a dairy product-restricted diet (vs. usual diet) had lower incidence of atopic dermatitis at 4 months of age.

Fermented milk and yogurt

Pregnancy: Two of the three cohort studies[3,26] showed an association between higher fermented milk and yogurt consumed during pregnancy and risk of atopic dermatitis/eczema. Specifically, in a Japanese study with a sample size of 1,354 participants, Miyake et al (2014)[26] noted that higher maternal yogurt intake during pregnancy was associated with a lower odds of physician-diagnosed atopic eczema in children aged 23 to 29 months. In a Norwegian cohort with 40,614 participants, Bertelsen et al[3] showed that higher maternal probiotic milk and yogurt consumption (vs. no consumption) was associated with a reduced risk of atopic eczema in the infant at 6 months of age. There was no association with eczema in the child at 18 months of age. In a stratified analysis, the authors compared no intake vs. child intake only vs. mother intake only vs. mother and child intake only and risk of eczema at 18 months and noted the following:

- Maternal intake only (vs. no intake) was associated with an increased risk of atopic eczema at 18 months in children (RR: 1.08, 95% CI: 1.01, 1.15)
- Mother and child intake (vs. no intake) was associated with statistically significant lower eczema risk at 18 months (RR: 0.93, 95% CI: 0.86, 1.00)

An earlier study published by Miyake et al[22] in 2010 showed that yogurt consumption during pregnancy was not associated with the risk of atopic dermatitis in the child. While the findings of this cohort study were not statistically significant, the directionality was consistent with the overall findings of the other two studies. [26 3].

None of the studies assessed an association between maternal fermented milk and yogurt consumption during lactation and risk of atopic dermatitis/eczema.

Egg

Pregnancy: Four studies, including two RCTs[7,14] and two cohort studies,[4,28] assessed the relationship between maternal egg consumption/avoidance during pregnancy and risk of atopic dermatitis. Specifically, the two trials[7,14] conducted in Sweden that randomized mothers to avoid egg consumption during pregnancy (in addition to avoiding milk products) showed no relationship between the avoidance diet and the risk of atopic dermatitis/eczema in the child. These findings were in line with the results of the U.S.-based cohort study[4] and a Japanese cohort study,[28] which both showed no association between eggs consumed during pregnancy and risk of atopic dermatitis in the child at 3-4 months of age[28] or 7.9 years.[4]

Pregnancy and lactation: A German NRCT (baseline n=150) showed that maternal avoidance of egg (in addition to avoiding cow milk products) during pregnancy and lactation was not associated with the risk of atopic dermatitis in the child during the first year of life (6 months, or 12 months).[10]

The three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: There were no other studies that assessed the relationship between maternal egg consumption during lactation and risk of atopic dermatitis/eczema in the child.

Fish

Pregnancy: Two of the seven cohort articles showed that higher consumption of fish during pregnancy was associated with a lower risk of atopic dermatitis/eczema in the child. Specifically, a U.K.-based cohort study[31] with a baseline sample size of 1,751 participants showed that higher maternal total fish consumption during pregnancy was associated with a lower risk of doctor-confirmed eczema in 5 year old children. Similarly, a cohort study[11] conducted in the Poland and the U.S. showed that higher maternal fish intake was associated with a lower risk of atopic dermatitis/eczema during the first year of life. Five other articles (from 4 cohorts) showed no association with the risk of atopic dermatitis during the first 2 years of life.[5,13,24,25,28] Three of these were conducted in Japan and two were conducted in a European population and all had at least 1,000 participants at baseline.

Lactation: No studies assessed the relationship between maternal fish consumption during lactation and risk of atopic dermatitis/eczema in the child.

Peanut, tree nut and seed

Pregnancy: Two studies, a U.S.-based cohort[4] (baseline n=2,128) and a study based in Spain and Greece[5] (baseline n=2,984), assessed the association between maternal peanut/nut consumption during pregnancy and risk of atopic dermatitis/eczema in the child and neither study showed an association. Of note, the Spain/Greece-based cohort study assessed nut consumption along with fruit consumption.

No studies showed an association between maternal tree nut and seed consumption during pregnancy and risk of atopic dermatitis/eczema in the child.

Pregnancy and lactation: Three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: None of the studies assessed the relationship between maternal peanuts,

tree nuts, or seed consumption during lactation and risk of atopic dermatitis/eczema in the child.

Soy

Pregnancy: The only prospective cohort study[4] that assessed the relationship between maternal soybean consumption during pregnancy and risk of atopic dermatitis/eczema in the child showed no association.

Pregnancy and lactation: The three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: No other studies assessed the relationship between maternal soybean consumption during lactation and risk of atopic dermatitis/eczema in the child.

Wheat

Pregnancy: One U.S.-based cohort study[4] showed that maternal wheat consumption during the second trimester was associated with a lower risk of atopic dermatitis in the child at 7.9 years. However, there was no association between first trimester maternal wheat consumption and risk of atopic dermatitis/eczema in the child. A European cohort study[5] conducted in Spain and Greece showed no association between maternal cereal consumption and risk of atopic dermatitis/eczema in the first year of life.

Pregnancy and lactation: Three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: None of the studies assessed the relationship between maternal wheat consumption during lactation and risk of atopic dermatitis/eczema in the child.

Dietary patterns

Pregnancy: Six articles from five studies[1,5,15,21,27,29] assessed the association between maternal DPs during pregnancy and risk of atopic dermatitis/eczema in the child. As described below, the studies assessed a variety of DPs:

1. Healthy DP, Western DP, and Japanese DP[21]
2. Mediterranean DP[5]
3. Diet quality score[27]
4. Vegetable, fruit and white rice DP, Seafood and noodles DP, Pasta, cheese and processed meat DP[15]
5. Mediterranean diet score[1]
6. Health conscious DP, Traditional DP, Processed DP, Vegetarian DP and Confectionary DP[29]

Despite the heterogeneity in the DPs, none of the maternal DPs during pregnancy were associated with the risk of atopic dermatitis/eczema in the child.

Lactation: There were no studies that assessed the relationship between maternal DPs consumed during lactation and atopic dermatitis/eczema in the child.

Other foods

Pregnancy: Five articles from three cohort studies assessed the relationship between

maternal consumption of other foods not commonly considered to be allergens, such as meat,[5,24,25,28] vegetables,[5,23] and fruits[5,23] during pregnancy and atopic dermatitis/eczema risk and noted the following:

- *Meat*: A Japanese cohort[28] with a baseline sample size of 1,002 participants showed that higher consumption of meat was associated with an increased risk of atopic dermatitis/eczema in the child; however, three other studies[5,24,25] (including one study from the same Japanese cohort[24]) showed no association.
- *Vegetables*: Of the two cohorts that assessed the association between maternal vegetable consumption and atopic dermatitis/eczema, the Japanese cohort[23] (baseline n=1,002) showed that a greater adherence to green and yellow vegetables was associated with a lower risk of atopic dermatitis/eczema in children at 16-24 months. However, intake of total vegetables and other vegetables was not associated with the risk of atopic dermatitis/eczema. Similarly, there were no associations between maternal vegetable consumption during pregnancy and atopic dermatitis/eczema risk in children at approximately 9-14 months in a European cohort.[5]
- *Fruits*: The same cohorts described in the above vegetables section also assessed the relationship between maternal fruit consumption during pregnancy and atopic dermatitis/eczema risk in the child.[5,23] While the Japanese cohort[23] showed that higher citrus fruit consumption was associated with a lower atopic dermatitis/eczema risk, no association was observed with maternal total fruit and apple consumption. Similarly, a European cohort study during pregnancy[5] found no association between fruit consumption (which was jointly assessed with nut consumption) and the risk of atopic dermatitis/eczema in the child.

Assessment of the evidence[vii]

Cow milk products

The following conclusion statement was supported by two RCTs[7,14] and five cohort studies[4,5,22,26,28] and was graded "moderate." Below, the individual grading elements are discussed separately for every study design.

"Moderate evidence indicates that lower or restricted consumption of cow milk products during pregnancy does not reduce the risk of atopic dermatitis/eczema in the child."

As outlined and described below, the body of evidence examining consumption of cow milk products during pregnancy and risk of atopic dermatitis/eczema in the child was assessed for the following elements used when grading the strength of evidence.

- **Risk of bias** was graded as moderate for the RCTs and limited for the cohort studies.
    - *RCTs* (**Table 6**): The two RCTs included in this body of evidence had notable flaws, as described below:

[vii] A detailed description of the methodology used for grading the strength of the evidence is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews and in Part C of the following reference: Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

        - Falth-Magnusson et al[7] reported issues with adherence to the assigned intervention. There was differential adherence to the intervention: 79 of the 104 mothers randomized to the intervention group adhered to the cow milk- and egg-free diet and provided follow-up data on their children at 18 months, while 102 of the 108 women randomized to control group adhered to the standard diet and provided follow-up data on their children at 18 months.
        - Lilja et al[14] reported potential issues with randomization. Mothers in the intervention group reported significantly higher IgE levels and greater prevalence of atopic eczema when compared to the control group. There were deviations from the intended intervention, with some of the women in the intervention group continuing with the intervention through lactation. There were challenges with selective reporting of results. Although the outcome was assessed throughout infancy and early childhood, atopic dermatitis was not reported during the earlier time points.
    - *Prospective cohort studies* (**Table 8**): Similar to the RCTs, the cohort studies had serious flaws in the design and conduct of the studies:
        - At least one of the key confounders was not controlled for in all of the included studies.
        - Dietary data reflected dietary intake at a single time point during pregnancy and may not have reflected the intake during the entire period of pregnancy.
        - Outcome data were self-reported and potentially subjective as they were reported by the participants who were aware of the exposure.
        - Studies included in this body of evidence had co-exposures that may have been related to both exposure and outcome.
        - None of the included studies had a pre-registered data analysis plan.
- **Consistency** was graded strong for RCTs and moderate for prospective cohort studies.
    - *RCTs*: Both RCTs[7,14] showed no relationship between avoiding cow milk product during pregnancy and risk of atopic dermatitis/eczema.
    - *Prospective cohort studies*: All five cohort articles[4,5,22,26,28] reported no association between maternal cow milk product consumption and risk of atopic dermatitis/eczema. The only exception was a sub-group analysis in the U.S.-based study that showed that higher consumption of cow milk products was associated with a lower risk of atopic dermatitis/eczema in the child. Because of this inconsistency, this grading element for prospective cohort studies was rated moderate.
- **Directness** was graded moderate for the RCTs and limited for prospective cohort studies.
    - *RCTs:* Both trials[7,14] were designed to assess the relationship between maternal cow milk product consumption and development of atopic diseases in infants and toddlers up to 18 months of age. In addition to the avoidance of cow milk products, the intervention group was also asked to avoid eggs. Hence, the findings might not have been attributable to cow milk product avoidance only.

For this reason, directness was graded moderate.

- *Prospective cohort studies*: While the articles[4,5,22,26,28] included in this body of evidence focused on addressing the systematic review question considered, the data for these articles were from larger cohort studies that addressed associations between different exposures/outcomes.

- **Precision** was graded moderate for both RCTs and prospective cohort studies.
  - *RCTs:* Precision was considered moderate because both trials had a reasonable sample size (baseline n= 171[14] and 212,[7] respectively). However, power calculations were not reported in either of the studies. Neither of the studies unduly influenced the findings of this systematic review and removing a single study from this body of evidence would not likely change the conclusions.
  - *Prospective cohort studies:* Precision for the prospective cohort studies was also considered moderate because there were an adequate number of studies that were sufficiently powered to assess the association. Baseline sample size included at least 1,000 participants in all these cohorts. No single article unduly affected the findings of this systematic review and removing one study would not impact the overall conclusions.

- **Generalizability** was graded limited for both RCTs and prospective cohort studies.
  - *RCTs*: Both trials were conducted in Sweden in the 1980s. However, the studies provided very minimal information on age, race/ethnicity and other SES characteristics and thus the applicability of the findings to the U.S. population is unclear. Given the dearth of information, generalizability for RCTs was graded limited.
  - *Prospective cohort studies:* For two of the five cohorts (corresponding to three articles[22,26,28]), 100 percent of participants were from Japan. Chatzi et al[5] combined findings from two cohort studies, one based in Spain and another one in Greece. However, the race/ethnicity of the participants was not reported. The only U.S.-based study[4] included in this body of evidence noted that most of the participants were White and were of moderate-to-high SES. Based on the characteristics of the participants in the cohorts, it is unclear if the findings would be representative of the U.S. mothers and hence generalizability was graded limited.

Egg

The following conclusion statement was supported by two RCTs[7,14] and two cohorts[4,28] and was graded moderate. Below, the individual grading elements are discussed separately for every study design.

*"*Moderate evidence indicates that lower or restricted consumption of egg during pregnancy does not reduce the risk of atopic dermatitis/eczema in the child."

As outlined and described below, the body of evidence examining consumption of eggs during pregnancy and risk of atopic dermatitis/eczema in the child was assessed for the following elements used when grading the strength of evidence.

(Note: The same RCTs[7,14] contributed to both (cow milk products and egg) bodies of evidence. Except for consistency, the individual grading elements for the RCTs are not discussed below and the readers are referred to the previous section on cow milk products.)

- **Risk of bias** (**Table 6**, **Table 8**) was graded moderate for the RCTs and limited for the prospective cohort studies.
    - *Prospective cohort studies:* There were serious flaws in the conduct of these studies,[4,28] including lack of accounting of all the key confounders, subjective outcome reporting, a single point of exposure assessment during pregnancy, and lack of a pre-registered data analysis plan.
- **Consistency** was graded strong for the RCTs and prospective cohort studies.
    - *RCTs:* There was a strong consistency in the findings in that both RCTs[7,14] showed no relationship between mother's avoidance of eggs during pregnancy and risk of atopic dermatitis/eczema.
    - *Prospective cohort studies:* Consistency for the prospective cohort studies[4,28] was considered to be strong as both studies showed no association between egg consumption and the risk of atopic dermatitis/eczema. These findings were also consistent with the RCTs findings.
- **Directness** was graded moderate for the RCTs and limited for the prospective cohort studies.
    - *Prospective cohort studies*: While the articles[4,28] included in this body of evidence focused on addressing the current systematic review question, the data for these articles were from larger cohort studies that addressed associations between different exposures and outcomes.
- **Precision** was graded moderate for the RCTs and limited for the prospective cohort studies.
    - *Prospective cohort studies:* Although the baseline sample size included at least 1,000 participants, there were only two cohort studies in this body of evidence. However, neither of them unduly affected the findings of this systematic review.
- **Generalizability** for the RCTs and the prospective cohort studies was graded limited.
    - *Prospective cohort studies:* The U.S.-based study[4] included in this body of evidence noted that most of the participants were White and were of moderate-to-high SES. One other cohort study was conducted in Japan. In this study, more than two-thirds of the participants had ≥ 13 years of education and most had moderate-to-high SES. Based on the characteristics of the participants included in the cohort, it is unclear if the findings would be representative of U.S. mothers.

Fish

The following conclusion statement was supported by six prospective cohort studies[5,11,13,24,25,28,31] and was graded "limited." The individual grading elements are discussed below.

"Limited evidence suggests that fish consumed during pregnancy does not increase the risk of atopic dermatitis/eczema in the child."

As outlined and described below, the body of evidence examining consumption of fish during pregnancy and risk of atopic dermatitis/eczema in the child was assessed for

the following elements used when grading the strength of evidence.

- **Risk of bias** (**Table 8**) was graded as limited as there were serious flaws in the design and conduct of the studies, which are described below:
    - At least one of the key confounders was not controlled for in all of the included studies.
    - Dietary data reflected dietary intake at a single time point during pregnancy and may not have reflected the intake during the entire period of pregnancy.
    - Outcome data were self-reported and potentially subjective as they were reported by the participants who were aware of the exposure.
    - Studies included in this body of evidence had co-exposures that may have been related to both exposure and outcome.
    - Two studies[5,11] in this body of evidence had possible selection bias issues and also had a potential for bias in classification of exposures.
    - None of the included studies had a pre-registered data analysis plan.
- **Consistency** for this body of evidence was considered to be limited. Two[11,31] of the seven articles reported that an increased consumption of fish during pregnancy was associated with a lower risk of atopic dermatitis and five articles[5,13,24,25,28] (representing four cohorts) showed no association. The inconsistencies in findings across studies can be partly attributed to the methodological limitations that were noted in this body of evidence, including bias due to classification of exposure, deviations from intended exposures, and missing outcome data.
- **Directness** was graded as limited. While the articles[5,11,13,24,25,28,31] included in this body of evidence focused on addressing the systematic review question, the data for these articles were from larger cohort studies that addressed associations between different exposures and outcomes.
- **Precision** was graded as moderate because there was an adequate number of studies that were sufficiently powered to assess the association. Sample sizes of most of the included studies in this body of evidence were at least 1,000 participants at baseline, with the exception of one study[11] that included 469 participants. No single article unduly affected the overall findings of this systematic review and removing one study would not impact the overall conclusions.
- **Generalizability** was graded limited. Two of the six cohorts (corresponding to three articles[24,25,28]) were conducted in Japan. Chatzi et al[5] combined findings from two cohort studies, one based in Spain and another one in Greece. However, the race/ethnicity of the participants was not reported. Two other European cohorts[13,31] were included in this body of evidence. Specifically, Leermakers et al[13] included 100 percent Dutch mothers from the Generation R cohort, noted that approximately 65 percent of the participants had ‘higher’ education. In the U.K.-based cohort, Willers et al[31] did not report race/ethnicity, but noted that mothers left full-time education at a median age of 18.5 years. Finally, the cohort study conducted in the U.S. and Poland noted that women had ~15.7 years of education, but did not provide other characteristics including race/ethnicity. Based on the characteristics of the participants in the cohorts, it is unclear if the findings would be generalizable to the U.S. mothers and hence generalizability was graded limited.

Dietary patterns

The following conclusion statement was supported by five prospective cohort studies[1,5,15,21,27,29] and was graded "limited." The individual grading elements are discussed below.

"Limited evidence suggests that dietary patterns during pregnancy are not associated with risk of atopic dermatitis/eczema in the child."

As outlined and described below, the body of evidence examining dietary patterns during pregnancy and risk of atopic dermatitis/eczema in the child was assessed for the following elements used when grading the strength of evidence.

- **Risk of bias** (**Table 8**) was graded as limited for the cohort studies because of the serious flaws in the design and conduct of the studies:
    - At least one of the key confounders was not controlled for in all of the included studies.
    - Dietary data reflected dietary intake at a single time point during pregnancy and may not have reflected the intake during the entire period of pregnancy.
    - Outcome data were self-reported and potentially subjective as they were reported by the participants who were aware of the exposure.
    - Studies included in this body of evidence had co-exposures that may have been related to both exposure and outcome.
    - One study[5] in this body of evidence had possible selection bias issues and potential for bias in classification of exposures.
    - None of the included studies had a pre-registered data analysis plan.
- **Consistency** was graded as strong as all of the included articles consistently showed no association between maternal dietary patterns during pregnancy and risk of atopic dermatitis/eczema in the child.
- **Directness** was considered to be limited. While the articles included in this body of evidence focused on addressing the systematic review question, the data for these articles are from larger cohort studies that addressed associations between different exposures and outcomes.
- **Precision** was graded as moderate because of the adequate number of studies that were sufficiently powered to assess the association. Baseline sample sizes included at least 1,000 participants in most of the cohorts, except the Singapore-based cohort,[15] which had a baseline sample size of 735. No single article unduly affected the findings of this systematic review and removing one study would not impact the overall conclusions.
- **Generalizability** was graded as limited. Of the studies conducted in Europe, two were from the same U.K.-based ALSPAC cohort,[1,29] one from Spain/Greece,[5] and one from the Netherlands.[27] The U.K.-based articles reported that most of the participants were White and possibly from mid-to-high SES. The other studies did not report the race/ethnicity of the mothers. The Singapore-based cohort study reported that all of the participants were Asian and the Japanese cohort study reporting that the 100 percent of the participants were from Japan. None of these studies were conducted in the U.S. Based on the characteristics of the participants in the cohorts, it is unclear if the findings would be representative of the U.S.

mothers.

Other foods

The bodies of evidence that assessed the relationship between:

- Peanuts, soybean, wheat/cereal, yogurt and probiotic milk products, and other foods (not commonly considered allergens, including meat, vegetables, and fruits) consumed during pregnancy,
- Cow milk products and eggs restricted during both pregnancy and lactation,
- Cow milk products restricted during lactation,

and risk of atopic dermatitis/eczema in the child were rated 'grade not assignable' for one or more of the following reasons:

- a very small body of evidence, usually less than two studies,
- heterogeneity in the findings,
- serious flaws in the design and conduct of the study, and
- limited generalizability of the findings to the U.S. population

Evidence synthesis – Allergic rhinitis

With 16 articles,[1,3,4,7,8,14,15,17-20,29,31,34-36] there is a modest body of evidence available to examine the relationship between maternal diet during pregnancy and lactation and allergic rhinitis in the child.

Cow milk products

Pregnancy: Five studies, including two RCTs[7,14] and three prospective cohort studies,[3,4,18], assessed the relationship between consumption of cow milk products during pregnancy and risk of atopic dermatitis in the child. The RCTs were specifically designed to assess the relationship between the avoidance of cow milk products during pregnancy and allergic rhinitis, whereas the cohort studies assessed the association between maternal consumption of cow milk products during pregnancy and allergic rhinitis in the child. Two RCTs showed that there was no relationship between maternal avoidance of cow milk during pregnancy and risk of allergic rhinitis in the child. A large Norway-based cohort study[3] (baseline n=40,614) showed that higher consumption of probiotic milk and yogurt during pregnancy was associated with a lower risk of rhinoconjunctivitis. Similarly, the U.S.-based cohort study[4] showed that higher intake of milk during the first trimester was associated with a lower risk of allergic rhinitis in the child and this association was primarily seen among those without parental atopy. There was no association between maternal milk consumption during the second trimester and risk of allergic rhinitis. On the other hand, a Denmark-based cohort study[18] (baseline n=61,909) noted that high intake of low-fat yogurt (> 1 serving per day vs. none) during pregnancy was associated with a greater risk of self-reported allergic rhinitis diagnosis in the child.

Pregnancy and lactation: A Japanese RCT,[8] conducted in high-risk families, randomized mothers to consume hypoallergenic formula and asked mothers in the intervention group to avoid cow milk products during late pregnancy and lactation. Results showed no difference in the prevalence of overall allergies (including allergic

rhinitis, asthma and atopic eczema) between children of the intervention and control group mothers and there was no difference in allergic rhinitis between groups at any age. The three articles[34-36] from a single U.S. trial met the inclusion criteria. The findings from these studies are presented in **Table 4**. However, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: No other studies assessed the relationship between maternal consumption of cow milk products during lactation and risk of allergic rhinitis in the child.

Egg

Pregnancy: Three studies, including two RCTs[7,14] and one cohort study,[4] assessed the relationship between maternal egg consumption/avoidance during pregnancy and risk of allergic rhinitis in the child. Specifically, the two trials[7,14] conducted in Sweden that randomized mothers to avoid consumption of eggs during pregnancy (in addition to avoiding milk products) showed no relationship between an avoidance diet and risk of allergic rhinitis. These findings were in line with the results of the U.S.-based cohort study,[4] which also showed no association between maternal consumption of eggs during pregnancy and risk of allergic rhinitis in the child at 7.9 years.

Pregnancy and lactation: Three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: No other studies assessed the relationship between maternal consumption of eggs during lactation and risk of allergic rhinitis in the child.

Fish

Pregnancy: Two cohort studies[19,31] assessed the association between maternal fish consumption during pregnancy and risk of allergic rhinitis. In the U.K.-based cohort study,[31] the authors reported that higher oily fish consumption (≥1 portion per week vs. never) was associated with a lower risk of doctor confirmed hay fever (allergic rhinitis). However, maternal oily fish consumption during pregnancy was not associated with hay fever (allergic rhinitis) in the child when the outcome was reported as “current hay fever medication” or “ever hay fever”. In a large Denmark-based cohort study,[19] maternal fish intake during pregnancy was not associated with “ever prescribed” allergic rhinitis (as described by the study). However, lower fish intake, when compared to higher fish intake, during pregnancy was associated with a reduced risk of self-reported allergic rhinitis diagnosis in the child (P for trend=0.01).

Lactation: None of the studies assessed the association between maternal fish consumption during lactation and risk of allergic rhinitis in the child.

Peanut, tree nut and seed

Pregnancy: A U.S.-based cohort[4] (baseline n=2,128) and a Denmark-based cohort study[17] (baseline n=61,908) assessed the association between maternal peanut consumption during pregnancy and risk of allergic rhinitis in the child. The U.S.-based cohort study showed no association between maternal peanut consumption during the first and second trimesters and allergic rhinitis risk. The Denmark-based cohort study[17] reported no association between maternal peanut (and pistachio) consumption during pregnancy and self-reported allergic rhinitis diagnosis. However, maternal consumption of peanuts (and pistachios) (1 time per month and 2-3 times per month

vs. never) during pregnancy was associated with lower odds of “ever prescribed” allergic rhinitis (as described in the study) in the child (P for trend=0.001).

The Denmark-based cohort study[17] also assessed the association between maternal tree nut consumption and risk of allergic rhinitis in the child and found no association.

Pregnancy and lactation: The three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: None of the studies assessed an association between maternal peanut, tree nut, seed consumption during lactation and risk of allergic rhinitis in the child.

Soy

Pregnancy: The U.S.-based cohort study,[4] found no association between maternal soy consumption during pregnancy and risk of allergic rhinitis in the child.

Pregnancy and lactation: Three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: None of the studies assessed the relationship between maternal soybean consumption during lactation and risk of allergic rhinitis in the child.

Wheat

Pregnancy: Bunyavanich et al,[4] the U.S.-based cohort study, showed no association between maternal wheat consumption during both the first and second trimesters and risk of allergic rhinitis in the child in mid-childhood.

Pregnancy and lactation: The three articles[34-36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: None of the studies assessed the relationship between maternal wheat consumption during lactation and allergic rhinitis in the child.

Dietary patterns

Pregnancy: Three articles from two cohort studies[1,15,29] assessed the association between maternal DPs and risk of allergic rhinitis in the child. As noted below, studies assessed a variety of DPs:

1. Vegetable, fruit, and white rice DP, Seafood and noodles DP, and Pasta, cheese and processed meat DP[15]
2. Mediterranean diet score[1]
3. Health conscious DP, Traditional DP, Processed DP, Vegetarian DP and Confectionary DP[29]

Despite the heterogeneity in the DPs, none of the maternal DPs were associated with the risk of allergic rhinitis in the child.

Lactation: There were no studies that assessed the relationship between maternal DPs during lactation and allergic rhinitis risk in the child.

Other foods

Pregnancy: A Denmark-based cohort study[20] (baseline n=60,465) reported that higher

consumption of artificially-sweetened carbonated soft drinks during pregnancy was associated with higher risk of self-reported childhood allergic rhinitis diagnosis compared to lower consumption (P for trend=0.01). No association was noted for other types of beverage consumption and allergic rhinitis risk in the child.

Lactation: There were no studies that assessed the relationship between maternal consumption of other foods during lactation and risk of allergic rhinitis in the child.

Assessment of the evidence[viii]

Egg

The following conclusion statement was supported by two RCTs[7,14] and one cohort study[4] and was graded moderate. Below, the individual grading elements are discussed separately for every study design.

"Moderate evidence indicates that lower or restricted consumption of eggs during pregnancy does not reduce the risk of allergic rhinitis in the child."

As outlined and described below, the body of evidence examining consumption of eggs during pregnancy and risk of allergic rhinitis in the child was assessed for the following elements used when grading the strength of evidence.

- **Risk of bias** was graded as moderate for the RCTs (**Table 6**) and limited for the cohort studies (**Table 8**).
    - *RCTs*: The two RCTs included in this body of evidence had notable flaws, as described below:
        - Falth-Magnusson et al[7] reported issues with adherence to the assigned intervention. There was differential adherence to the intervention: 79 of the 104 mothers randomized to the intervention group adhered to the cow milk- and egg-free diet and provided follow-up data on their children at 18 months, while 102 of the 108 women randomized to control group adhered to the standard diet and provided follow-up data on their children at 18 months.
        - Lilja et al[14] reported potential issues with randomization with mothers in the intervention group reporting significantly higher IgE levels and greater prevalence of atopic eczema when compared to the control group. There were deviations from the intended intervention with some of the women in the intervention group continuing with the intervention through lactation. There were challenges with selective reporting of results. Although outcome was assessed throughout infancy and early childhood, atopic dermatitis was not reported at individual time points.
    - *Prospective cohort study*: Similar to the RCTs, the cohort study[4] had serious flaws in the design and conduct of the study:
        - At least one of the key confounders was not controlled for in the cohort

[viii] A detailed description of the methodology used for grading the strength of the evidence is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews and in Part C of the following reference: Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

study.
    - Outcome data were self-reported and potentially subjective as they were reported by the participants who were aware of the exposure.
    - The study did not have a pre-registered data analysis plan.

- **Consistency** was graded as strong for the RCTs and grade not assignable for the prospective cohort study.
    - *RCTs*: There was a strong consistency in the findings. Both RCTs[7,14] showed no relationship between avoidance of egg during pregnancy and risk of allergic rhinitis in the child.
    - *Prospective cohort study*: Consistency could not be assessed since only one prospective cohort study was included in this body of evidence.
- **Directness** was graded strong for the RCTs and limited for the prospective cohort study.
    - *RCTs:* Both trials[7,14] were designed to assess the relationship between maternal avoidance of egg during pregnancy and development of atopic diseases in infants and toddlers up to 18 months of age.
    - *Prospective cohort study*: Although the study[4] focused on addressing the systematic review question, this study is part of the larger Project Viva cohort that addressed associations between different exposures and outcomes.
- **Precision** was graded moderate for the RCTs and limited for the prospective cohort study.
    - *RCTs:* Precision was considered moderate because both trials had a reasonable sample size (baseline n= 171[14] and 212[7]). However, power calculations were not reported in either of the studies. Neither of the studies unduly influenced the findings of this systematic review and removing a single study from this body of evidence would not likely change the conclusions.
    - *Prospective cohort study*: Precision for the prospective cohort study was considered to be limited because only one study was included in this body of evidence.
- **Generalizability** was graded limited for both the RCTs and the prospective cohort study.
    - *RCTs:* Both trials were conducted in Sweden in the 1980s. However, the studies provided very minimal information on maternal age, race/ethnicity and other socioeconomic characteristics and thus applicability of the findings to the U.S. population is unclear. Given the dearth of information, generalizability for RCTs was graded limited.
    - *Prospective cohort study*: Although the study was conducted in the U.S., the participants were predominantly White and were of mid-to-high SES. Based on the characteristics of the participants in the cohorts, it is unclear if the findings would be representative of U.S. mothers and hence generalizability was graded limited.

Dietary patterns

The following conclusion statement was supported by three articles[1,15,29] and was graded "limited." The individual grading elements are discussed below.

"Limited evidence suggests that dietary patterns during pregnancy are not associated with the risk of allergic rhinitis in the child."

As outlined and described below, the body of evidence examining dietary patterns during pregnancy and risk of allergic rhinitis in the child was assessed for the following elements used when grading the strength of evidence.

- **Risk of bias** (**Table 8**) was graded as limited for the prospective cohort studies because of the serious flaws in the design and conduct of the studies, as described below:
    - At least one of the key confounders was not controlled for in all of the included studies.
    - Dietary data reflected dietary intake at a single time point during pregnancy and may not have reflected intake during the entire period of pregnancy.
    - Outcome data were self-reported and potentially subjective as they were reported by the participants who were aware of the exposure.
    - None of the included studies had a pre-registered data analysis plan.
- **Consistency** was graded as strong since all of the included studies consistently showed no association between maternal DPs and risk of allergic rhinitis in the child.
- **Directness** was graded as limited. While the articles included in this body of evidence focused on addressing the systematic review question, the data are from larger cohort studies that address associations between different exposures and outcomes.
- **Precision** was considered moderate because of the adequate number of studies that were sufficiently powered to assess the association. The two U.K.-based articles[1,29] (from the same ALSPAC cohort) had a sample size of at least 1,000 participants at baseline, and the Singapore-based cohort[15] had a baseline sample size of 735. No single cohort unduly affected the findings of this systematic review and removing one study would not impact the overall conclusions.
- **Generalizability** was graded as limited. The two articles that were from the same U.K.-based ALSPAC cohort[1,29] reported that most of the participants were White and were of mid-to-high SES. The Singapore-based cohort study reported that a majority of the participants were Chinese (approximately 59 percent). None of these studies were conducted in the U.S. Based on the characteristics of the participants in the included studies, it is unclear if the findings would be representative of the U.S. mothers and hence generalizability was graded limited.

Other foods

The bodies of evidence that assessed the relationship between:

- Cow milk products (fermented or non-fermented) consumed during pregnancy, or during both pregnancy and lactation,
- Fish, peanuts, tree nuts, soybean, wheat, and foods not commonly considered

to be allergens, such as meat, vegetables, and fruits consumed during pregnancy,

and risk of allergic rhinitis in the child were rated 'grade not assignable' for one or more of the following reasons:

- a very small body of evidence, usually less than two studies,
- heterogeneity in the findings,
- serious flaws in the design and conduct of the study, and
- limited generalizability of the findings to the U.S. population.

Evidence synthesis – Asthma

With 20 included articles,[1-4,6,8,9,17-20,27,29-34,36,38] including two RCTs[8,34,36] and nine prospective cohort studies,[1-4,6,8,9,17-20,27,29-34,36,38] there is a substantial body of evidence available to examine the relationship between maternal diet during pregnancy and/or lactation and asthma in the child (**Table 5**).

Cow milk products

Pregnancy: Four prospective cohort studies[3,4,18,32] assessed the association between maternal cow milk product consumption and risk of asthma. Of these, two European cohort studies showed no association between maternal cow milk product consumption (i.e. probiotic milk and yogurt,[3] dairy[32]) and asthma risk in children.

Two other studies reported a significant association, at least in certain sub-groups. Specifically, the U.S.-based cohort study[4] showed that a higher consumption of milk during the first trimester was associated with a lower asthma risk at 7.9 years. However, there was no association between maternal milk intake second trimester and subsequent asthma risk in the child. The Denmark-based cohort study[18] showed that dairy product and milk intake during pregnancy was not associated with childhood asthma. The association between yogurt intake and asthma risk was mixed. Higher consumption of maternal low-fat yogurt intake (vs. lower intake) during pregnancy was associated with a greater risk (P for trend=0.03) for "ever admitted" asthma (as described in the study) in the child, whereas higher maternal full-fat yogurt intake during pregnancy, compared to lower intake, was associated with a reduced risk (P for trend=0.01) for "ever prescribed asthma" (as described in the study) in the child.

Pregnancy and Lactation: One Japan-based RCT[8] showed no association between maternal avoidance of cow milk products during pregnancy and lactation and risk of asthma in children. Two articles[34,36] from a single U.S. trial met the inclusion criteria. The findings from these studies are presented in **Table 5**. However, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: One Finland-based prospective cohort study[38] assessed the association between maternal milk and milk product consumption during lactation (3 months postpartum) and asthma risk in the child at 5 years and reported no association.

Egg

Pregnancy: Two studies, a U.S.-based cohort study with a baseline sample size of 2,128[4] and U.K.- based study with a baseline sample size of 1,715,[4,32] assessed the

association between maternal egg consumption during pregnancy and risk of asthma. Neither of the studies showed an association between maternal egg consumption during pregnancy and risk of asthma in children.

Pregnancy and lactation: Two articles[34,36] from a single U.S. trial met the inclusion criteria; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: There were no studies that assessed the relationship between maternal egg consumption during lactation and risk of asthma in the child.

Fish

Pregnancy: Three European cohort studies (with a baseline sample size of 28,936 in the Denmark-based study,[19] 3,963 in the Netherlands-based study,[32] and 897 in the Ireland-based study[30]) assessed the association between maternal fish consumption during pregnancy and risk of asthma in children. Two of these studies [30,32] showed no association with the risk of asthma in children. In the third study,[19] fish intake during pregnancy was not associated with the risk of "ever admitted" asthma (as described in the study) or current asthma at 7 years. However, no fish intake (vs. high fish intake) during pregnancy was associated with a higher risk of "ever prescribed asthma" (as described in the study) in the child.

Lactation: One Finland-based prospective cohort study[38] assessed the association between maternal fish consumption during lactation (3 months postpartum) and asthma risk in the child at 5 years and reported no association.

Peanut, tree nut and seed

Pregnancy: Three prospective cohort studies assessed the association between peanut/nut consumption during pregnancy and risk of asthma in the child. The evidence was mixed. Specifically, the Danish cohort study[17] reported that higher peanut (and pistachio) consumption, compared to lower consumption, was associated with a reduced risk (P for trend=0.002) of "ever admitted" asthma (as described by the study). The Netherlands-based study,[32] however, showed that higher nut product (including peanut butter) consumption was associated with a higher risk of childhood asthma at 3-8 years, when compared to lower intake. In the U.S.-based study[4], peanut consumption during the first or second trimesters was not associated with the risk of asthma in the child.

The Denmark-based cohort study[17] also assessed the association between maternal tree nut consumption during pregnancy and asthma. Higher tree nut consumption, compared to lower consumption, was associated with a reduced risk (P for trend=0.0003) of "ever prescribed" asthma (as described by the study) in the child. However, the Netherlands-based study[32] noted that consumption of nuts (including tree nuts, peanuts, almonds, Brazil nuts, cashews, macadamia nuts, pistachios) was not associated with the risk of asthma in children.

There were no studies that showed an association between maternal seed consumption during pregnancy and risk of asthma in the child.

Pregnancy and lactation: Two articles[34,36] from a single U.S. trial met the inclusion criteria for asthma; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: None of the studies assessed an association between maternal peanut, tree

nut, or seed consumption during lactation and risk of asthma in the child.

Soy

Pregnancy: The only prospective cohort study[4] that assessed the relationship between maternal soybean consumption during pregnancy and risk of asthma in childhood showed no association.

Pregnancy and lactation: Two articles[34,36] from a single U.S. trial met the inclusion criteria for asthma; however, they were not considered in evidence synthesis, grading, or when drawing conclusions for the reasons described above (p. 31).

Lactation: No other studies assessed the relationship between maternal soybean consumption during lactation and risk of asthma in the child.

Dietary Patterns

Pregnancy: Four cohort studies[1,6,9,27,29] that assessed an association between maternal DPs and risk of asthma in the child. As noted below, studies assessed a variety of DPs (as described below):

1. Healthy Eating Index (HEI)[6]
2. Dietary Inflammatory Index (DII)[6,9]
3. Diet quality score[27]
4. Mediterranean diet score[1]
5. Health conscious DP, Traditional DP, Processed DP, Vegetarian DP and Confectionary DP[29]

Despite the heterogeneity in DPs, four articles that assessed the maternal DPs during pregnancy showed no association with the risk of asthma in the child. The only exception was the Irish study[6] that showed that lower diet quality, assessed using HEI and DII, was associated with a higher risk of asthma.

Lactation: There were no studies that assessed the relationship between maternal DPs during lactation and asthma risk in the child.

Other foods

Pregnancy: Seven articles assessed the relationship between maternal consumption of other foods such as vegetables,[2,5,23,30-32] fruits,[2,31,32] wheat/whole grains,[4,31] and asthma risk and noted the following:

- Vegetables: Of the four prospective cohort studies[2,30-32] that assessed the association between maternal vegetable consumption during pregnancy and risk of asthma, none showed an association with asthma risk. All four studies were conducted in Europe and had a baseline sample size of at least 1,000 participants (except one study[30] with a baseline sample size of 897).
- Fruits: Three prospective cohort studies[2,30-32] assessed the association between maternal fruit consumption during pregnancy and risk of asthma in children. Specifically, the U.K.-based cohort study reported no association between maternal total fruit consumption during pregnancy and risk of asthma at 5 years of age.[31] However, consumption of apples during pregnancy was associated with a lower risk of asthma in the child. In the second study, maternal fruit consumption was not associated with overall asthma risk from 3-8 years of age.[32] However, the study noted one significant association between maternal fruit consumption and steroid

use at 6 years of age.[32] Another U.K.-based study showed no association between total fruit intake and risk of asthma in the child at 7.5 years.[2]

- Wheat/whole grain: Two prospective cohort studies assessed the association between maternal wheat/whole grain consumption and asthma risk in the child and neither of the studies showed an association.[4,31] (Note: Whole grain included whole grains, wholemeal bread, bran flakes/sultana bran/all bran, shredded wheat/Weetabix, muesli, porridge, and brown rice).
- Other beverages: Two prospective cohort studies assessed the association between maternal beverage consumption during pregnancy and risk of asthma. Specifically, the U.S.-based study[33] noted that a higher maternal consumption of sugar-sweetened beverages averaged across the first and second trimesters of pregnancy was associated with an increased odds of asthma in the child at 7.7 years, compared to low consumption. The Danish cohort study noted that higher maternal consumption of artificially-sweetened carbonated (P for trend=0.01) and non-carbonated soft drink intake (P for trend=0.001) during pregnancy was associated with a higher risk of "ever prescribed" asthma in childhood (as described in the study), compared with lower intake. However, sugar-sweetened soft drink consumption during pregnancy was not associated with the risk of childhood asthma.
- Margarine/low fat spread: One study that assessed the relationship between maternal consumption of margarine/low fat spread during pregnancy and risk of asthma in the child found no association.[31]

Lactation: Margarine/oils/industrial fats/butter and butter-spreads/meat and meat products: One Finnish prospective cohort study[38] assessed the association between maternal consumption of margarine, oils, industrial fat (as reported in the study), meat and meat products during lactation and asthma risk in the child. The study reported that higher maternal margarine consumption at 3 months postpartum, compared to no intake, was associated with higher risk of asthma at 5 years. However, there was no association between maternal consumption of oils, industrial fats, butter and butter-spreads, meat and meat products and asthma risk in the child.

Assessment of the evidence[ix]

Cow milk products

The following conclusion statement was supported by four prospective cohort studies[3,4,18,32] and was graded "limited." The individual grading elements are discussed below.

"Limited evidence suggests that a lower consumption of cow milk products during pregnancy does not reduce risk of asthma in the child."

As outlined and described below, the body of evidence examining consumption of cow milk products during pregnancy and risk of asthma in the child was assessed for the

[ix] A detailed description of the methodology used for grading the strength of the evidence is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews and in Part C of the following reference: Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

following elements used when grading the strength of evidence.

- **Risk of bias** (**Table 8**) was graded as limited.
    - The cohort studies[3,4,18,32] had serious flaws in the design and conduct of the study:
        - At least one of the key confounders was not controlled for in all of the cohort studies.
        - Two studies[18,32] in this body of evidence had possible selection bias issues.
        - Studies included in this body of evidence had co-exposures that may have been related to both the exposure and the outcome.
        - Outcome data were self-reported and potentially subjective as they were reported by the participants who were aware of the exposure.
        - Studies did not have a pre-registered data analysis plan. There was a high likelihood of selective reporting of the analysis in at least one study.[18]
- **Consistency** was graded as moderate.
    - Two prospective cohort studies[3,32] reported no association between maternal cow milk product consumption during pregnancy and risk of asthma. The third study[4] reported an association between maternal milk consumption during the first trimester only (and not the second trimester) and asthma risk. The fourth study[18] reported mixed findings, with higher consumption of low-fat yogurt associated with a greater risk of asthma and higher consumption of high-fat yogurt associated with lower risk of asthma. The inconsistency in findings can be partially attributed to the methodological issues, as described in the risk of bias section.
- **Directness** was graded as limited.
    - Although the prospective cohort studies[3,4,18,32] focused on addressing the systematic review question, these studies were part of larger cohort studies that addressed associations between different exposures/outcomes.
- **Precision** was graded as limited.
    - Precision for the prospective cohort studies was considered to be limited. There were four prospective cohort studies that were sufficiently powered to assess the association. Baseline sample sizes included at least 1,000 participants in all these cohorts. No single cohort unduly affected the findings of this systematic review and removing one study would not impact the overall conclusions.
- **Generalizability** was graded as limited.
    - One study[4] was conducted in the U.S. and participants were predominantly White and from mid-to-high SES. The rest of the studies[3,18,32] included in this body of evidence were conducted in Europe. While the studies did not report on race/ethnicity, the three European studies noted that the majority of the participants had some college education. Based on the characteristics of the participants in these cohorts, it is unclear if the findings would be representative of the U.S. mothers and hence generalizability was graded limited.

Egg

The following conclusion statement was supported by two prospective cohort studies[4,32] and was graded "limited." The individual grading elements are discussed below.

"Limited evidence suggests no relationship between eggs consumed during pregnancy and risk of asthma in the child."

As outlined and described below, the body of evidence examining consumption of eggs during pregnancy and risk of asthma in the child was assessed for the following elements used when grading the strength of evidence.

- **Risk of bias** (**Table 8**) was graded as limited for cohort studies. Both studies[4,32] had serious flaws in the design and conduct of the study:
  - At least one of the key confounders was not controlled for in both studies.
  - The Netherlands study[32] had possible selection bias issues.
  - There were issues with missing data in both of the studies.
  - Outcome data were self-reported and potentially subjective as they were reported by the participants who were aware of the exposure.
  - Studies did not have a pre-registered data analysis plan.
- **Consistency** was graded as strong as both of the included studies consistently showed no association between maternal egg consumption during pregnancy and risk of asthma in the child.
- **Directness** was graded as limited. While the articles included in this body of evidence focused on addressing the systematic review question, the data for these articles are from larger cohort studies that addressed associations between different exposures/outcomes.
- **Precision** was limited. Although both studies had a sample size of at least 1,000 participants at baseline, there were only two studies included in this body of evidence. Neither study unduly affected the findings of this systematic review; removing one study would not impact the overall conclusions.
- **Generalizability** was graded as limited. One study[4] was conducted in the U.S. with predominantly White participants who were of mid-to-high SES. The Dutch study[32] noted that approximately 22 percent had low maternal education, although the study did not define "low." There was no information on the race/ethnicity of the participants. Based on the characteristics of the participants in the included studies, it is unclear if the findings would be representative of U.S. mothers and hence generalizability was graded limited.

Fish

The following conclusion statement was supported by three prospective cohort studies[19,30,32] and was graded "limited." The individual grading elements are discussed below.

"Limited evidence suggests no relationship between fish consumed during pregnancy and risk of asthma in the child."

As outlined and described below, the body of evidence examining consumption of fish during pregnancy and risk of asthma in the child was assessed for the following elements used when grading the strength of evidence.

- **Risk of bias** (**Table 8**) was graded limited for the prospective cohort studies because of the serious flaws in the design and conduct of the studies, as described below:
  - At least one of the key confounders was not controlled for in all of the cohort studies.
  - All three studies in this body evidence had possible selection bias issues.
  - Studies included in this body of evidence had co-exposures that may have been related to both exposure and outcome.
  - Outcome data were self-reported and potentially subjective as they were reported by the participants who were aware of the exposure.
  - Studies did not report a pre-registered data analysis plan. There was a possibility of selective reporting of the analysis in at least one of the three studies.[30]
- **Consistency** was graded as moderate as two of the included studies consistently showed no association between maternal fish consumption during pregnancy[30,32] and risk of asthma. In the third study, fish intake during pregnancy was not associated with risk of "ever admitted" asthma or current asthma at 7 years.[19] However, no fish intake (vs. high fish intake) during pregnancy was associated with a higher risk of "ever prescribed" asthma.
- **Directness** was graded as limited. While the articles included in this body of evidence focused on addressing the systematic review question, the data for these articles are from larger cohort studies that addressed associations between different exposures/outcomes.
- **Precision** was considered moderate because there was an adequate number of studies that was sufficiently powered to detect the association. The sample sizes in all three studies were reasonable and ranged from 897[30] to 28,936 participants[19] at baseline. No single cohort unduly affected the overall findings of this systematic review and removing one study would not impact the overall conclusions.
- **Generalizability** was graded as limited. None of these studies were conducted in the U.S. These European cohort studies did not report the race/ethnicity of the participants; however, the Viljoen et al[30] reported that all participants were 100 percent Ireland-born. Based on the characteristics of the participants in the included studies, it is unclear if the findings would be representative of U.S. mothers and hence generalizability was graded limited.

Other foods

The bodies of evidence that assessed the relationship between:

- Cow milk products consumed during both pregnancy and lactation, or lactation,
- Maternal dietary patterns or peanuts, tree nuts, soybean, and other foods such as wheat/whole grains, vegetables, fruits, beverages, and margarine consumed

during pregnancy,

- Fish, and other foods, such as margarine, oil, butter and butter-spreads, industrial fat, meat, and meat products consumed during lactation,

and risk of asthma in the child were rated ‘grade not assignable’ for one or more of the following reasons:

- a very small body of evidence, usually two studies or less,
- heterogeneity in the findings,
- serious flaws in the design and conduct of the study, and
- limited generalizability of the findings to the U.S. population.

Publication bias is an important consideration in this systematic review and can be perceived to be a concern because of the fewer number of studies within each intervention/exposure-outcome relationships. However, this systematic review included studies that reported null findings in both relatively small and large studies, which suggests that publication bias may be less of a concern in this body of evidence.

Research recommendations

- Include well-designed RCTs and prospective cohort studies that assess the relationship between maternal diet and risk of atopic dermatitis/eczema, food allergies, allergic rhinitis and asthma.
- Assess intervention/exposure at multiple time points during pregnancy and/or during lactation.
- Adjust for key confounding factors in observational studies, including maternal age, race/ethnicity, socioeconomic status, smoking, family history of atopic allergic diseases, gestational age at birth, birth weight, mode of delivery, human milk feeding practices (intensity, duration), types of complementary foods and beverages and timing of its introduction, urban/rural environment, animals/pets/farming exposure; sex, maternal substance use (alcohol, drug use), and Indoor and outdoor environment.
- Include diverse populations with varying age groups and different racial/ethnic and socioeconomic backgrounds.

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Table 2. Description of evidence on the relationship between maternal diet during pregnancy and lactation and risk of child food allergy[x, xi]

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Pregnancy			
Prospective Cohort Studies			
Bunyavanich, 2014[4]; U.S. PCS, Project Viva Baseline N=2,128 Analytic N=616 Of 1277 that were followed-up, 616 participants agreed to have blood drawn • Age: ~32.3 (from other Project Viva data) • Race/Ethnicity: White: 69% • SES: • Maternal Education: ≥college graduate: 69.3% • Household income ≥$70K: 63.0% • Reported but not tested by exposure: Family history	**Food(s) or Food Group(s):** Maternal consumption of major food allergens (servings/d *z*-scores) • Peanut: ○ 1st trimester: 0.34± 0.44 ○ 2nd trimester: 0.36± 0.43 • Milk: ○ 1st trimester: 1.16± 1.04 ○ 2nd trimester: 1.50± 1.82 • Wheat: ○ 1st trimester: 2.65± 1.48 ○ 2nd trimester: 2.69± 1.44 • Egg: ○ 1st trimester: 0.32± 0.30 ○ 2nd trimester: 0.33± 0.30 • Soy: ○ 1st trimester: 0.08± 0.27 ○ 2nd trimester: 0.08± 0.28 at 10wk and 26-28wk gestation **Dietary assessment methods:**	**Significant:** Maternal intake of peanuts (z-score of servings/day of foods) during 1st trimester: aOR=0.53, 95% CI: (0.30, 0.94) **Non-significant:** Maternal 1st trimester intake of any food allergens (milk, egg, wheat, soy), P=NS Maternal 2nd trimester intake of any food allergens (milk, egg, wheat, peanuts, or soy) P=NS Stratification by parental atopy showed no association between intake of milk, wheat, egg, and soy during 1st or 2nd trimester and food allergies.	**Key confounders accounted for:** (Race/Ethnicity adjusted in a secondary model), SES, Family history, HMF **OFCs accounted for:** Child sex **Limitations:** • Critical co-exposures NR • Mothers who participated in the study were different than those who were lost to follow-up on the following characteristics: maternal race, college education, income, parental atopy • Proportions of and reasons for missingness NR by exposure • Multiple exposure outcome comparisons were assessed without using an appropriate p-value correction • Self-reported exposure and outcome (for clinical symptoms)

[x] ± indicates values of Mean± SD unless otherwise noted

[xi] AAP: American Academy of Pediatrics, ALSPAC: Avon Longitudinal Study of Parents and Children, aOR: adjusted odds ratio, aRR: adjusted risk ratio, BW: birth weight, CD: Cow's milk diet, CFB: complementary food and beverage, CI: confidence interval, d: day, FFQ: food frequency questionnaire, GI: gastrointestinal, HMF: human milk feeding, MD: Mom hypoallergenic formula, mo: month(s), NR: not reported, NS: non-significant, OFCs: other factors considered, PCS: prospective cohort study, Q#: quartile, RCT: randomized control trial, Ref: Reference, sIgE: serum immunoglobulin E, SES: socioeconomic status; wk: week(s), y: year(s)

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Maternal dietary assessments at the first and second trimester visits were based on a validated 166-item semi-quantitative FFQ modified for pregnancy. The total servings per day of each major food allergen (peanut, milk, wheat, egg, and soy) were calculated by summing the servings per day of the foods on the FFQ containing these respective food allergens. **Outcome:** Food Allergy at ~7.9 y **Outcome assessment methods:** Sensitization to a food allergen was considered positive if the respective allergen sIgE level was 0.35 kU/L or more. Prescription of an epinephrine autoinjector was assessed with the question, ‘‘Has a health care professional, such as a doctor, physician assistant, or nurse practitioner, ever prescribed an EpiPen for your child?’’ A child was considered to have food allergy to peanut, milk, wheat, egg, and/or soy if he or she had a sIgE level of 0.35 kU/L or more to the particular food and EpiPen prescribed.		• Pre-registered data analysis plan NR **Summary:** Maternal intake of any major food allergens (peanuts, milk, egg, wheat or soy) in the 1st trimester or 2nd trimester was not associated with risk of food allergy in the child at 7.9 y.
Lack, 2003[12]; U.K. **PCS, ALSPAC** Baseline N=13,971 Analytic N=11,352	**Food(s) or Food Group(s):** Soybean meat consumption (yes/no) Assessed once at 32 wk gestation	**Significant:** **Non-significant:** Soybean meat consumption	**Key confounders accounted for:** None **OFCs accounted for:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
		Yes vs No (Ref): P=NS	None
• Age: NR • Race/Ethnicity: NR • SES: NR • Baseline characteristics NR by exposure	**Outcome:** Food allergy at 38 mo **Outcome assessment methods:** Children ≤38 mo who had peanut allergy on the basis of responses to questions about food avoidance and reactions to particular foods were identified. Affected children were also identified from responses to questions on the questionnaire regarding previous hospitalizations and clinical investigations. Forty-nine mothers of children who had a reaction to peanuts according to questionnaire responses were interviewed in detail over the telephone about the reaction. Children who were found to have had a reaction to peanuts (age range, four to six years) underwent skin testing and double-blind, placebo-controlled food challenge. Skin testing was performed with peanut (concentration, 1:20 [wt/vol] in 50 percent glycerol). A skin test was considered positive if it resulted in a palpable wheal at least 3 mm in diameter. Peanut food allergy at 4-6y confirmed by double-blind, placebo-controlled food challenge	Only among those with positive peanut challenge: Yes vs No (Ref): P=NS	**Limitations:** • No key confounders controlled for • Exposure status and methods used to assess the exposure are not well defined. It is not clear what soybean meat included. • Potential for selection bias, since the participants that only responded to the allergy question in the questionnaire were included in the study • No information on deviation from intended exposure or on proportions and reasons for missing data across exposure groups • No pre-registered data analysis plan **Summary:** Maternal soybean meat consumption during pregnancy was not associated with risk of peanut allergy at 4-6 y.
Pregnancy and Lactation			
Randomized Controlled Trials			
Fukushima, 1997[8]; Japan **RCT**	**Food(s) or Food Group(s):**	**Significant:** Note, CD had significantly higher odds of overall allergies vs MD at	**Key confounders accounted for:** Smoking, Family history, (CFB for aOR), Pets

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Baseline N=350 Analytic N=283 • Age: NR • Race/Ethnicity: 100% from Japan • SES: NR • Significant differences by exposure (by design): HMF, CFB • No differences by exposure: Smoking, Family history, BW, Pets • ~76% had a positive history of allergy (i.e., both parents or one parent or sibling only had history of allergies)	• CD: Mothers instructed to consume >200mL/d cow milk, n=140 randomized, n=127 analyzed • MD: Mothers instructed to consume >200mL/d a casein-free, hypoallergenic formula and to avoid cow milk and reduce consumption of cow milk products, n=140 randomized, n=102 analyzed • AF: Mothers instructed to consume >200mL/d a casein-free, hypoallergenic formula and to avoid cow milk and reduce consumption of cow milk products, n=70 randomized, n=54 analyzed (Not randomized, no relevant comparisons included, except as co-variates in logistic regressions) ○ Also supplemented with 1000 mg/d Ca during late pregnancy through end of lactation up to 6 mo postpartum From birth to 6 mo, the infants in the MD and CD groups were exclusively HMF or mixed-fed with breast milk and casein-free, hypoallergenic formula when breast milk was insufficient. The infants in the AF group were mixed-fed with breast milk and a formula with similar whey:casein ratio as breastmilk for the corresponding 6 mo. Infants who were fed breast milk exclusively from birth to 4mo were excluded from the AF group. **Dietary assessment methods:**	12mo, but due to inclusion of asthma as part of the outcome, these results do not meet the NESR criteria **Non-significant:** Median total IgE levels at 4mo, P=NS • CD: 3.20 IU/mL • MD: 3.36 IU/mL Overall allergies at 24mo, P=NS • CD: aOR=1.75, 95% CI: (0.94, 3.25) • MD: (Ref) Note, odds of overall allergies NS at 6 and 18 mo. However, due to inclusion of asthma these results do not meet the NESR criteria	**OFCs accounted for:** None **Limitations:** • Randomization process NR • MD still consumed cow milk products, but had lower intake than CD • Attrition higher in MD group because women excluded from analysis if they consumed cow milk • Proportions of missing data seem to differ, reasons for missingness NR • Participants were aware of exposure status and outcomes were self-reported • Pre-registered data analysis plan NR **Summary:** Consuming diets replacing cow milk with casein-free hypoallergenic formula with reduced consumption of cow milk products from late pregnancy through lactation did not impact overall allergies, including atopic eczema, asthma and allergic rhinitis in the child.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Daily food diary from late pregnancy until 6mo postpartum, recording the amount of casein-free, hypoallergenic formula, cow milk, cow milk products, eggs, meat, and soy products consumed. **Outcome:** Overall allergies (eczema, asthma, and/or allergic rhinitis) at 24mo **Outcome assessment methods:** Self-reported by questionnaire. Specific allergies defined when symptoms chronically lasted for more than a few weeks. Umbilical cord blood and venous blood obtained from all infants at birth and 4mo of age. Total IgE in serum was measured using a radioimmunoassay (RIA) kit. Cow milk-specific IgE level in serum was measured by the CAP-RAST method. Specific IgE (RAST) was considered positive when the level was more than 0.35UA/mL.		
Zeiger, 1989[35]; U.S. **RCT** Baseline N=379 Analytic N=288 Power analysis: Yes	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation, n=212 ○ Cow milk-based whey infant formula provided for supplementation or weaning through 12 mo postpartum. CFB	**Significant:** Food allergy at 12 mo • Total cumulative prevalence, P=0.007 ○ Control (n=177): 16.4% ○ Prophylactic (n=99): 5.0%	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **Limitations:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Of these families, 14 in each group were found to be not atopic, which eliminated them from the study Baseline characteristics for 288 participants • Age: ~28.6 y • Race/Ethnicity: ○ Non-White: ~12.5% • SES: ○ Maternal occupation: white collar: ~54.0% ○ Family income <$20,000/y: ~9.7% ○ Maternal Education: ▪ ≤High school: ~13.6% • Characteristics reported with significant differences by exposure ○ BW (term, singletons) • Characteristics reported with no differences by exposure ○ Smoking ○ Family history ○ HMF ○ CFB ○ Animal/Pets/Farming exposure Families were included in the study if at least one parent met the following criteria: history of an atopic disorder and specific IgE by	encouraged: no solids <4 mo, cereal at 4 mo, followed by vegetables, fruits and egg yolks at 6 mo, meats at 8 mo, and whole cow milk and egg whites at 12 mo. • Prophylaxis: Instructed to avoid totally all milk (dairy), egg, and peanut products, avoid concentrated soy foods (i.e., tofu), ≤2 servings/d wheat, with other grains to fulfill cereal and starch requirements during 3rd trimester of pregnancy and lactation, n=167 ○ In addition to prenatal vitamins, the maternal diet was supplemented with a total of 1500 mg/d Ca. ○ A casein hydrolysate infant formula with low sensitization potential provided for supplementation or weaning through 12 mo postpartum. CFB encouraged: no solids <6 mo, non-legume vegetables, followed by rice cereal at 7 mo, meats at 8 mo, non-citrus fruits and juices at 9 mo, and cow milk at 12 mo. Wheat, soy, corn, and citrus introduced thereafter at monthly intervals, followed by egg at 24 mo and peanuts and fish at 36 mo. • Both groups encouraged to feed human milk for ≥4-6 mo **Dietary assessment methods:** Women were randomly assigned to groups. In addition to instructions described above, women in prophylaxis group attended a dietary class was held	Food allergy at 24 mo • Total cumulative prevalence, P=0.005 ○ Control (n=169): 20.1% ○ Prophylactic (n=97): 7.2% • Probable cumulative prevalence, P=0.021 ○ Control (n=169): 11.2% ○ Prophylactic (n=97): 3.1% Period prevalence of food-specific allergies, at each time point at 4, 12, and 24 mo • Milk ○ 4 mo, P=NS ○ 12 mo, Control > Prophylactic, P=0.013 Cumulative prevalence of food-specific allergies, at each time point at 4, 12, and 24 mo • Any food ○ 4 mo, P=0.069 ○ 12 mo, P=0.074 ○ 24 mo, Control > Prophylactic, P=0.019 • Egg, P=NS • Milk ○ 4mo, P=NS ○ 12mo, Control > Prophylactic, P=0.007 ○ 24mo, Control > Prophylactic, P=0.001 **Non-significant:** Food allergy at 4 mo	• Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers. • Some missing data, but power calculation suggests the analytic N is sufficient to test hypotheses. • Physician making diagnosis was aware of exposure status; outcomes required both lab tests and observations at multiple time points, with similar results for • "probable" and "definite" diagnoses. • No pre-registered data analysis plan. **Summary:** Maternal avoidance of milk (dairy), egg, and peanut products, avoidance of concentrated soy foods, and limited intake of wheat during the 3rd trimester of pregnancy through lactation, and reduced infant food allergen exposure during CFB reduced the prevalence of some food allergies in the child through 24 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
skin or RAST testing. Serum was obtained from the participants for total and specific IgE determinations. Participant fathers were skin tested to inhalant antigens at the intake session. Mothers were skin tested to foods and inhalants 4 mo postpartum.	before the 3rd trimester by a licensed dietitian to provide detailed instructions on the maternal and infant diets, food lists, recipes, and product sources. Adherence to the dietary regimen was ascertained in part by maternal self-report and daily diaries. For both groups: 0.25mg/d Tri-Vi-Flor given to infants according to their pediatrician's preference. Foods causing documented IgE sensitization were removed from the infant's diet until sensitization had waned or were tolerated on double-blind challenge. Parents received intensive education on reducing environmental allergens and tobacco smoke from their homes. **Outcome:** Atopic dermatitis, Allergic rhinitis, Food allergy at 1, 4, 8, and 12 mo **Outcome assessment methods:** Food allergy defined as probable when food-specific IgE was associated with atopic dermatitis, urticaria/angioedema induced at least twice by foods, and GI allergy. Formula allergy was a component of food allergy in which any of the above symptoms occurred after ingestion of study formula with the presence of concomitant milk-specific IgE. A positive double-blind food challenge or a severe food reaction with coexisting food-specific IgE was considered definite food allergy.	• Allergy to casein hydrolysate, P=0.053 ○ Contol (n=161): 4.3%. 95% CI: (1.8, 8.8%) ○ Prophylactic (n=89): 0%, 95% CI: (0.0, 4.1%) Food allergy at 12 mo • Definite cumulative prevalence, P=0.059 ○ Control (n=177): 7.9% ○ Prophylactic (n=99): 2.0% • Probable cumulative prevalence, P=NS Food allergy at 24 mo • Definite cumulative prevalence, P=NS Period prevalence of food-specific allergies, P=NS at each time point at 4, 12, and 24 mo • Any food • Egg	

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Prophylactic infants used casein hydrolysate (Nutramigen) for supplementation or weaning, and avoided solid foods for 6 mo; cow milk, corn, soy, citrus, and wheat, for 12 mo; and egg, peanut, and fish, for 24 mo. Infants in the control groups Enfamil, a cow milk-based whey infant formula. Solid foods were introduced to control-group infants, based on AAP recommendations.		
Zeiger, 1992[36]; U.S. **RCT** Baseline N=379 Analytic N=242 (at 3y) and N=225 (at 4y) ***See Zeiger, 1989[35]***	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation • Prophylaxis: Avoided all milk (dairy), egg, and peanut products, concentrated soy foods (i.e., tofu), ≤2 servings/d wheat during 3rd trimester of pregnancy and lactation ○ Prenatal vitamins plus supplemented with a total of 1500 mg/d Ca Both groups encouraged to feed human milk for ≥4-6 mo **Outcome:** Food allergy at 4 y Period prevalence: Defined as the proportion of participants currently evidencing a measured parameter	**Significant:** 4-year Cumulative Prevalence Control Group vs Prophylaxis: aRR=2.5, 95% CI=(1.1, 5.6), P<0.05 **Non-significant:** Period prevalence at 3 and 4 y: Prophylaxis vs Control: NS Cumulative prevalence: Prophylaxis vs Control: NS	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets (Based on Zeiger, 1989[35] paper) **OFCs accounted for:** Sex **Limitations** (Note: most of these limitations were identified based on Zeiger 1989[35] paper) • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers • Rate of drop-out at baseline was significantly different in the prophylaxis vs. control groups (p<0.0001)

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Cumulative prevalence: Defined as the proportion of subject evidencing the measured parameter at any past or current time Prophylactic infants used casein hydrolysate (Nutramigen) for supplementation or weaning, and avoided solid foods for 6 mo; cow milk, corn, soy, citrus, and wheat, for 12 mo; and egg, peanut, and fish, for 24 mo. Infants in the control groups Enfamil, a cow milk-based whey infant formula. Solid foods were introduced to control-group infants, based on AAP recommendations.		• Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups **Summary:** There was no relationship between maternal avoidance of dairy, eggs, peanut, wheat and soy during pregnancy and risk of food allergy at 3 and 4 y.
Zeiger, 1995[34]; U.S. **RCT** Baseline N=379 Analytic N=165 ***See Zeiger, 1989[35]***	**Food(s) or Food Group(s):** • Control (n=106): Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation • Prophylaxis (n=59): Avoided all milk (dairy), egg, and peanut products, concentrated soy foods (i.e., tofu), ≤2 servings/d wheat during 3rd trimester of pregnancy and lactation ○ Prenatal vitamins plus supplemented with a total of 1500 mg/d Ca Both groups encouraged to feed human milk for ≥4-6 mo **Outcome:** Food allergy defined as atopic dermatitis, urticaria/angioedema, or	**Significant:** **Non-significant:** Any food-specific allergy Period prevalence, P=NS Cumulative prevalence, P=0.06 (explained by differences <2y)	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **OFCs accounted for:** Sex **Limitations:** • Unclear if the participants that were lost to follow-up (since the baseline study) were any different than participants that completed the study. More participants were lost to follow up in the prophylaxis group than the control group. • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result,

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	diarrhea/vomiting occurring on at least two occasions or anaphylaxis induced by a specific food with concurrent food-specific IgE at 7 y of age Prophylactic infants used casein hydrolysate (Nutramigen) for supplementation or weaning, and avoided solid foods for 6 mo; cow milk, corn, soy, citrus, and wheat, for 12 mo; and egg, peanut, and fish, for 24 mo. Infants in the control groups Enfamil, a cow milk-based whey infant formula. Solid foods were introduced to control-group infants, based on AAP recommendations.		halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers • Rate of drop-out was significantly different in the prophylaxis vs. control groups ($p<0.0001$). • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups **Summary:** Maternal avoidance of milk (dairy), egg, and peanut products, avoidance of concentrated soy foods, and limited intake of wheat during the 3rd trimester of pregnancy through lactation, and reduced infant food allergen exposure during CFB did not affect the prevalence of food allergy in the child at 7 y, replicating previously reported findings at 3 y and 4 y.

Table 3. Description of evidence on the relationship between maternal diet during pregnancy and lactation and risk of child atopic dermatitis/eczema[xii, xiii]

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Pregnancy			
Randomized Controlled Trials			
Falth-Magnusson, 1987[7]; Sweden, RCT Baseline N=212 Analytic N=181 Power calculation: Yes • Age: NR • Race/Ethnicity: NR • SES: NR • Significant differences by exposure: HMF, CFB • No differences by exposure: Smoking (infant exposure), Family history, BW, Animal/Pets/Farming exposure	**Food(s) or Food Groups(s):** • Non-Diet (ND): Mothers encouraged to follow standard diets, n=108 randomized, 102 adhered and completed follow-up • Diet (D): Strictly milk- and egg-free diet, n=104, 79 adhered and completed follow-up ○ Supplemented with casein hydrolysate formula and Ca supplement for a total of 1200 mg/d Ca from 28 wk through delivery Both groups encouraged to feed human milk By their own choice, many mothers limited milk and egg intake during lactation: at both 6 wk and 3 mo, D-true	**Significant:** **Non-Significant:** Probable atopic dermatitis, P=NS Definite atopic dermatitis, P=NS	**Key confounders accounted for:** Family history, Animal/Pets/Farming exposure **OFCs accounted for:** None **Limitations:** • Age at weaning: D-true (7.06 mo), ND-true (5.98 mo), P<0.005; Full or partial HMF at 6 wk and 6 mo, P=NS • Infant CM introduction by 6 mo: D-true (55.1%), ND-true (81.2%), P<0.0005 • Unclear whether sex was balanced: D-true (32F, 47M), ND-true (40F, 62M) • One pair of twins included, not accounted for in analyses (group NR) • 3 infants born preterm, all in D group • ~50% of women adhered to casein hydrolysate

[xii] ± indicates values of Mean± SD unless otherwise noted

[xiii] AAP: American Academy of Pediatrics, ALSPAC: Avon Longitudinal Study of Parents and Children, aOR: adjusted odds ratio, aRR: adjusted risk ratio, BW: birth weight, Ca: Calcium, CFB: complementary food and beverage, CI: confidence interval, d: day, DHQ: diet history questionnaire, DP: dietary pattern, FFQ: food frequency questionnaire, GA: gestational age, GUSTO: Growing Up in Singapore Towards Healthy Outcomes, HMF: human milk feeding, INMA: INfancia y Medio Ambiente, IQR: interquartile range, IRR: incidence rate ratio, ISAAC: International Study of Asthma and Allergies in Childhood, KOMCHS: Kyushu Okinawa Maternal and Child Health Study, MD: Mediterranean diet, mo: month(s), MoBa: Mothers and Babies cohort, MUFA: monounsaturated fatty acid, NR: not reported, NS: non-significant, OFCs: other factors considered, OMCHS: Osaka Maternal and Child Health Study, PCA: principal component analysis, PCS: prospective cohort study, Q#: quartile, RCT: randomized control trial, Ref: Reference, SES: socioeconomic status, SFA: saturated fatty acid, SPT: skin prick test, T#: tertile, wk: week(s), y: year(s)

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
All women had a personal history of allergy (asthma, rhinoconjunctivitis, and atopic eczema) or this was present in at least one of the family member (husband or child)	group had greater proportion of mothers with complete avoidance (P<0.05) or low intake of ≤2 dL/wk milk and ≤2 eggs/wk (P<0.0001). **Outcome:** Atopic dermatitis at 18 mo Probable, definite **Outcome assessment methods:** All babies who demonstrated any signs and symptoms suggesting atopic disease or allergy before the age of 18 mo were examined by a senior pediatric allergist. The selection of examination was based on the information from the questionnaires, available case records, results of two skin prick tests and the result of a nurse visit at 18 mo. All babies demonstrating positive SPTs on any occasion were examined, as well as babies with a history of either otitis media, bronchitis, or pseudocroup on two or more occasions, and babies whose parents or the nurse had suspected eczema at any time. The aim of the physical examination at 18 mo was to score whether the child up to the age of that age had demonstrated definite, probable, possible, or no signs of atopic diseases. A question mark after atopic dermatitis points out that some but not all of the diagnostic features were present.		• Differences in HMF duration and CFB could have influenced the outcome • Attrition of 15% still left >180 participants required by estimate from power calculation • Lost to follow-up was higher in the D group than the ND group • High risk participants (i.e., either the mother, father or another child had history of allergy). Thus, the findings may not be entirely generalizable • No pre-registered data analysis plan **Summary:** Maternal avoidance of milk and eggs during 28 wk gestation through delivery was not associated with atopic dermatitis in the child at 18 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Lilja, 1989[14]; Sweden **Cluster RCT** Baseline N=171 Analytic N=162 • Age: ~28.7 y • Race/Ethnicity: NR • SES: NR • Characteristics reported with no difference by exposure ○ Smoking ○ Family history ○ HMF ○ CFB timing, types ○ Animal/Pets/Farming exposure Women in this study had a history of respiratory allergy symptoms after exposure to animal danders (cat and dog) and/or tree or grass pollens	**Food(s) or Food Group(s):** • High: Consumed "normal" amounts of hens' egg and cows' milk, n=83 • Reduced: Strictly reduced ingestion of egg and dairy products (milk, yogurt, butter, cheese, etc.), n=79 ○ Reduced A-Group: Women chose to continue reduced diet through 2mo postpartum (n=25) ○ Reduced B-Group: Women adhered to study design and stopped reduced diet after delivery (n=54) from 28 wk gestation until delivery (until 2mo postpartum for A-Group) **Dietary assessment methods:** Women were randomly assigned to groups. In reduced group, no foods obviously containing egg or cows' milk were allowed, but small amounts of these foods, such as bread brushed with egg or ordinary margarines, were allowed. **Outcome:** Atopic disease: Atopic eczema Rhinoconjunctivitis at 2, 6, 12 and 18 mo **Outcome assessment methods:** All children were examined at 2, 6, 12, and 18 mo. The physicians who performed the physical examination at 18 mo were unaware of the mothers' diet during the trial and of previously	**Significant:** **Non-significant:** Atopic disease by 18mo • There were no significant differences between any groups (High, Reduced, A-Group, B-Group) in cumulative prevalence of obvious, probable, or possible atopic disease. • Similar lack of association between maternal diet and obvious, probable, or possible atopic eczema, rhinoconjunctivitis • Similar lack of association between maternal diet and obvious, probable, or possible atopic disease in sensitivity analyses of different feeding methods during the first 6 mo postpartum: ○ HMF >6 mo ○ HMF >2mo/<6 mo + soy formula ○ HMF >2 mo/< 6mo + cows' milk/soy formula ○ HMF <2 mo + soy formula	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **OFCs accounted for:** Child sex **Limitations:** • There was a significantly higher incidence of atopic eczema and higher IgE levels before week 28 in the 'reduced' group. • Data <18 mo measured but NR. • 4 pairs of twins included, but family relation is not accounted for in analyses. • Although a cluster RCT, it is probable that the data analysis was conducted at the individual level. **Summary:** Higher (vs reduced) intake of egg and dairy products during pregnancy did not impact child's eczema risk at 18 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	performed SPT and in-vitro analyses in the mother and child. The cumulative incidence of signs of atopic diseases ≥18 mo was evaluated by a questionnaire and the physical examination into the following groups: obvious atopic, probable atopic, possible atopic, and the type of atopic symptom was noted. The infants were followed with SPTs and with serum samples for analyses of the levels of antibodies to selected food allergens.		
Prospective Cohort Studies			
Miyake, 2009[24]; Japan **PCS, OMCHS** Baseline N=1,002 Analytic N=763 Of the 1002 participants, 867 mother-child pairs participated in the 2nd survey (2-9mo postpartum), 763 participated in the 3rd survey (16-24mo postpartum). • Age: 30.0± 4.0y • Race/Ethnicity: NR (likely 100% Japanese) • SES: ○ Maternal educational (y)	**Food(s) or Food Group(s):** Fish consumption by quartile, n=763 assessed once during pregnancy (17.7± 6.7wk gestation) Meat consumption by quartile, n=763 assessed once during pregnancy (17.7± 6.7wk gestation) **Dietary assessment methods:** Participants completed a self-administered, semiquantitative, 150-item comprehensive DHQ that assessed dietary habits during the preceding month. DHQ validated in women, and estimates of daily intake for foods were based on the Standard	**Significant:** **Non-significant:** Eczema • Fish, P for trend=NS • Meat, P for trend=NS	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, BW, HMF, Urban/Rural environment (residential municipality) **OFCs accounted for:** Sex **Limitations:** • Although the diet data was collected during pregnancy, there was a wide variability as to when the data was collected (range: 5-39 wk). • Outcome measurement was subjective and was reported by the participants, who were aware of the exposure. • Study was conducted in Japan, so the findings may not be entirely generalizable.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
▪ <13: 27.8% ▪ 13-14: 43.1% ▪ ≥15: 29.1% ○ Annual household income (yen) ▪ <4,000,000: 27.7% ▪ 4,000,000–5,999,999: 41.0% ▪ ≥6,000,000: 31.3% • Other characteristics reported but no test for differences by exposure: ○ Smoking ○ Family history of atopic disease ○ BW ○ HMF	Tables of Food Composition in Japan. Surveys were completed at enrollment, ~17.7 wk gestation. **Outcome:** Atopic Dermatitis: Eczema at 16-24 mo **Outcome assessment methods:** Symptoms of eczema were defined as in the ISAAC in a self-administered questionnaire at 16-24 mo postpartum. For eczema, affirmative answers to the following 3 questions were required: "Has your child ever had an itchy rash which was coming and going for at least 6 months?" "Has your child had this itchy rash at any time in the last 12 months?" and "Has this itchy rash at any time affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears, or eyes?"		**Summary:** Higher maternal fish or meat intake during pregnancy was not associated with odds of eczema in children at 16-24 mo.
Miyake, 2010[23]; Japan PCS, OMCHS Baseline N=1,002 Analytic N=763 ***See Miyake, 2009[24]***	**Food(s) or Food Group(s):** Total vegetable consumption by quartile, n=763 Median energy-adjusted intake (g/d): Q1: 90.9 Q2: 144.4 Q3: 189.8 Q4: 288.4 assessed once during pregnancy (~17.7± 6.7 wk gestation)	**Significant:** Eczema • Green and yellow vegetables, P for trend=0.01 ○ Q1: Reference, Cases n=54 ○ Q2: Cases n=22, aOR=0.30, 95% CI: (0.16–0.52) ○ Q3: Cases n=34, aOR=0.53, 95% CI: (0.31–0.89) ○ Q4: Cases n=32, aOR=0.41, 95% CI: (0.24–0.71)	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking (household), Family history, BW, HMF, Urban/Rural environment (residential municipality) **OFCs accounted for:** Sex **Limitations:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Total fruit consumption by quartile, n=763 Median energy-adjusted intake (g/d): Q1: 49.6 Q2: 114.3 Q3: 176.4 Q4: 290.8 assessed once during pregnancy (~17.7± 6.7 wk gestation) Also examined outcomes by intake (by quartiles) of green and yellow vegetables; other vegetables; apples; and citrus fruit **Dietary assessment methods:** Participants completed a self-administered, semiquantitative, 150-item comprehensive DHQ that assessed dietary habits during the preceding month. DHQ validated in women 31-69 y, and estimates of daily intake for foods were based on the Standard Tables of Food Composition in Japan. Surveys were completed at enrollment, ~17.7 wk gestation. Green and yellow vegetable consumption included intake of carrots, pumpkin, tomatoes, tomato juice, sweet peppers, broccoli, and dark-green leafy vegetables such as spinach and komatsuna. Intake of other vegetables	• Citrus fruit, P for trend=0.03 ○ Q1: Reference, Cases n=49 ○ Q2: Cases n=34, aOR=0.61, 95% CI: (0.36–1.02) ○ Q3: Cases n=31, aOR=0.57, 95% CI: (0.33–0.98) ○ Q4: Cases n=28, aOR=0.53, 95% CI: (0.30–0.93) **Non-significant:** Eczema • Total vegetables, P for trend=NS • Other vegetables, P for trend=NS • Total fruit, P for trend=NS • Apples, P for trend=NS	• Although the diet data was collected during pregnancy, there was a wide variability as to when the data was collected (range: 5-39 wk). • Outcome measurement was subjective and was reported by the participants, who were aware of the exposure. • Study was conducted in Japan, so the findings may not be entirely generalizable. **Summary:** Higher maternal intake of green and yellow vegetables and citrus fruit during pregnancy was associated with lower odds of eczema in children at 16-24 mo. Higher maternal intake of total vegetables, other vegetables, total fruit, and apples during pregnancy was not associated with odds of eczema in children at 16-24 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	included that of cabbage, cucumber, lettuce, Chinese cabbage, bean sprouts, Japanese radish, onion, cauliflower, eggplant, burdock, lotus root, vegetable juice, umeboshi, and salt pickles. Fruit consumption was defined as intake of raisins, canned fruits, fruit juice, citrus fruit, bananas, apples, strawberries, grapes, peaches, Japanese pears, Japanese persimmons, kiwifruit, melon, and watermelon. Because only a small number of participants used vitamin C (5.6%) and multivitamin (4.2%) supplements ≥1/wk, information on these dietary supplements was not considered in the present analysis. **Outcome:** Atopic Dermatitis: Eczema at 16-24mo **Outcome assessment methods:** *See Miyake, 2009*[24]		
Miyake, 2010[22]**; Japan PCS, OMCHS** ***See Miyake, 2009***[24]	**Food(s) or Food Group(s):** Total dairy products consumption by quartile, n=763 Median energy-adjusted intake (g/d): Q1: 43.6 Q2: 120.8 Q3: 184.5 Q4: 280.7	**Significant:** **Non-significant:** Eczema • Total dairy products, P for trend=NS • Milk, P for trend=NS • Yogurt, P for trend=NS • Cheese, P for trend=NS	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, BW, HMF, Urban/Rural environment (residential municipality) **OFCs accounted for:** Sex **Limitations:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	assessed once during pregnancy (~17.7± 6.7wk gestation) Also examined outcomes by intake (by quartiles) of milk; yogurt; and cheese **Dietary assessment methods:** Participants completed a self-administered, semiquantitative, 150-item comprehensive DHQ that assessed dietary habits during the preceding month. DHQ validated in women 31-69y, and estimates of daily intake for foods were based on the Standard Tables of Food Composition in Japan. Surveys were completed at enrollment, ~17.7wk gestation. Total dairy product intake was considered as the sum of milk, yogurt and cheese. Information on dietary supplements was not used because only a small number of participants used calcium (5.5%) and multivitamin (4.2%) supplements ≥1/wk. **Outcome:** Atopic Dermatitis: Eczema at 16-24mo **Outcome assessment methods:** *See Miyake, 2009*[24]		• Although the diet data was collected during pregnancy, there was a wide variability as to when the data was collected (range: 5-39wk). • Outcome measurement was subjective and was reported by the participants, who were aware of the exposure. • Study was conducted in Japan, so the findings may not be entirely generalizable. **Summary:** Higher maternal intake of total dairy products, milk, yogurt, and cheese during pregnancy was not associated with odds of eczema in children at 16-24 mo.
Miyake, 2011[21]; Japan	Food(s) or Food Group(s):	**Significant:**	**Key confounders accounted for:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
PCS, OMCHS Baseline N=1,002 Analytic N=763 ***See Miyake, 2009*[24]**	Dietary Pattern, by quartiles of adherence • Healthy: represented higher intake of green and yellow vegetables, seaweed, mushrooms, white vegetables, pulses, potatoes, fish, sea products, fruit, and shellfish and lower intake of confectioneries and soft drinks • Western: high intake of vegetable oil, salt-containing seasonings, beef and pork, processed meat, eggs, chicken, and white vegetables and low intake of fruit, soft drinks, and confectioneries • Japanese: high intake of rice, miso soup, sea products, and fish and low intake of bread, confectioneries, and dairy products assessed once during pregnancy (~17.7± 6.7 wk gestation) **Dietary assessment methods:** Participants completed a self-administered, semiquantitative, 150-item comprehensive DHQ that assessed dietary habits during the preceding month. DHQ validated in women 31-69 y, and estimates of daily intake for foods were based on the Standard Tables of Food Composition in Japan. Surveys were completed at enrollment, ~17.7 wk gestation. 145 food items on the DHQ were grouped into 33 predefined food groups	**Non-significant:** Eczema • Healthy pattern, P for trend=NS • Western pattern, P for trend=NS • Japanese pattern, P for trend=NS Results of the sensitivity analysis were consistent with the main findings.	Age, Race/Ethnicity, SES, Smoking, Family history, BW, HMF, Urban/Rural environment (residential municipality) **OFCs accounted for:** Sex **Limitations:** • Although the diet data was collected during pregnancy, there was a wide variability as to when the data was collected (range: 5-39wk). • Outcome measurement was subjective and was reported by the participants, who were aware of the exposure. • Study was conducted in Japan, so the findings may not be entirely generalizable. **Summary:** Adherence to Healthy, Western, or Japanese dietary patterns during pregnancy was not associated with odds of eczema in children at 16-24 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	to extract dietary patterns. Five items were excluded (cornflakes, nutritional supplement bars, Japanese-style pancakes, noodle soup, and drinking water). Information on dietary supplements was not used in the calculation of dietary intake. Dietary patterns obtained via factor analysis. Scores for each pattern and for each individual were determined by summing the intake of each food group weighted by the factor loading. All data presented here are from the Varimax rotation. The validity of dietary patterns derived from the DHQ has been previously reported. **Outcome:** Atopic Dermatitis: Eczema at 16-24 mo **Outcome assessment methods:** *See Miyake, 2009*[24]		
Saito, 2010[28]; Japan **PCS, OMCHS** Baseline N=1002 Analytic N=771 Of the 1002 participants, 867 mother-child pairs participated in the 2nd survey (2-9 mo postpartum). After further excluding 96	**Food(s) or Food Group(s):** Dairy product consumption by quartile, n=771 Median energy-adjusted intake (g/d): Q1: 52.7 Q2: 126.0 Q3: 191.0 Q4: 288.3	**Significant:** Eczema • Meat, P for trend=0.01 ○ Q1: Reference, Cases n=10 ○ Q2: Cases n=14, aOR=1.46, 95% CI: (0.61–3.62) ○ Q3: Cases n=19, aOR=2.41, 95% CI: (1.06–5.75) ○ Q4: Cases n=22, aOR=2.59, 95% CI: (1.15–6.17)	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Family history, BW, HMF, Urban/Rural environment (residential municipality) **OFCs accounted for:** Sex, Indoor/outdoor environment **Limitations:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
participants, the final sample size was 771. • Age: 29.9± 4.0y • Race/Ethnicity: NR (likely 100% Japanese) • SES: ○ Maternal educational (y) ▪ <13: 28.7% ▪ 13-14: 42.4% ▪ ≥15: 28.9% ○ Annual household income (yen) ▪ <4,000,000: 29.1% ▪ 4,000,000 – 5,999,999: 39.7% ▪ ≥6,000,000: 31.3% • Other characteristics reported but no test for differences by exposure: ○ Family history of atopic disease ○ BW ○ HMF	assessed once during pregnancy (17.8± 6.8wk gestation) Egg consumption by quartile, n=771 Median energy-adjusted intake (g/d): Q1: 9.7 Q2: 22.9 Q3: 40.7 Q4: 61.3 assessed once during pregnancy (17.8± 6.8 wk gestation) Fish consumption by quartile, n=771 Median energy-adjusted intake (g/d): Q1: 23.0 Q2: 37.8 Q3: 51.4 Q4: 73.1 assessed once during pregnancy (17.8± 6.8 wk gestation) Meat consumption by quartile, n=771 Median energy-adjusted intake (g/d): Q1: 33.4 Q2: 49.1 Q3: 63.6 Q4: 89.8 assessed once during pregnancy (17.8± 6.8 wk gestation)	**Non-significant:** Eczema • Dairy products, P for trend=NS • Eggs, P for trend=NS • Fish, P for trend=NS	• Although the diet data was collected during pregnancy, there was a wide variability as to when the data was collected (range: 5-39 wk). • Outcome measurement was subjective and was reported by the participants, who were aware of the exposure. • Study was conducted in Japan, so the findings may not be entirely generalizable. **Summary:** Higher meat intake during pregnancy was associated with greater odds of eczema in children at 3-4 mo. There was no significant association between intake of dairy products, eggs, or fish during pregnancy and odds of eczema in the child.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Dietary assessment methods: Participants completed a self-administered, semiquantitative, 150-item comprehensive DHQ that assessed dietary habits during the preceding month. DHQ validated in women, and estimates of daily intake for foods were based on the Standard Tables of Food Composition in Japan. Surveys were completed at enrollment, ~17.8 wk gestation. **Outcome:** Atopic Dermatitis: Eczema at 3-4 mo **Outcome assessment methods:** Symptoms of eczema were assessed with a self-administered questionnaire at 3-4 mo postpartum. Suspected atopic eczema was considered to be present if the mother selected any one of the following answers to the written question: “Has your child been diagnosed by a physician as having atopic eczema and treated with topical steroids?”: (i) my child has been diagnosed with atopic eczema and treated with topical steroids (n = 23); (ii) my child has been diagnosed with atopic eczema but has not been treated with topical steroids (n = 11); (iii) my child has been diagnosed with atopic eczema and treated with a unknown ointment (n = 1); (iv) my child has been		

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	diagnosed as possibly having atopic eczema and has been treated with topical steroids (n = 29) or (v) my child has been diagnosed as possibly having atopic eczema but has not been treated with topical steroids (n = 1).		
Miyake, 2014[26]; Japan PCS, KOMCHS Baseline N=1,757 Analytic N=1,354 • Age: 31.5± 4.1y • Race/Ethnicity: NR (likely 100% Japanese) • SES: ○ Maternal educational (y) ▪ <13: 21.6% ▪ 13-14: 33.6% ▪ ≥15: 44.8% ○ Annual household income (yen) ▪ <4,000,000: 33.5% ▪ 4,000,000 -5,999,999: 36.7% ▪ ≥6,000,000: 29.8% • Other characteristics reported but no test for differences by exposure: ○ Smoking ○ Family history of atopic disease ○ BW ○ HMF	**Food(s) or Food Group(s):** Dairy product consumption by quartile, n=1,354 assessed once during pregnancy (5-39 wk gestation) **Dietary assessment methods:** Participants completed a self-administered, semiquantitative, 150-item comprehensive DHQ that assessed dietary habits during the preceding month. Surveys were completed at enrollment, between 5 and 39wk gestation. Research technicians completed missing or illogical data by telephone interview. Total dairy product intake was defined as the sum of the calculated daily intake of milk, yogurt, and cheese. **Outcome:** Atopic Dermatitis: Eczema at ~24 mo **Outcome assessment methods:** Symptoms of eczema were defined as in the ISAAC in a self-administered questionnaire at ~24mo postpartum. For eczema, affirmative answers to the following 3 questions were required: "Has your child ever had an itchy rash which was coming and going for at least 6 months?" "Has your child had	**Significant:** Physician-diagnosed atopic eczema Total yogurt products, P for trend=0.01 • Q1: Reference, Cases n=16 • Q2: Cases n=27, aOR=1.52, 95% CI: (0.78-3.04) • Q3: Cases n=10, aOR=0.48, 95% CI: (0.20-1.10) • Q4: Cases n=9, aOR=0.49, 95% CI: (0.20-1.16) Sensitivity analysis showed consistent findings for physician diagnosed atopic eczema. **Non-significant:** Eczema • Total dairy products, P for trend=0.054 ○ Q1: Reference, Cases n=69 ○ Q2: Cases n=57, aOR=0.80, 95% CI: (0.54-1.19) ○ Q3: Cases n=57, aOR=0.82, 95% CI: (0.55-1.22) ○ Q4: Cases n=46, aOR=0.64, 95% CI: (0.42-0.98)	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, BW, HMF **OFCs accounted for:** Sex **Limitations:** • Although the diet data were collected during pregnancy, there was a wide variability as to when the data was collected (range: 5-39 wk). • Outcome measurement was subjective and was reported by the participants, who were aware of the exposure. • Study was conducted in Japan, so the findings may not be entirely generalizable. **Summary:** Higher maternal yogurt intake, but not milk, cheese, or total dairy intake, during pregnancy was associated with lower odds of physician-diagnosed atopic eczema in children by 24 mo. Higher maternal total dairy, milk, yogurt, or cheese intake during pregnancy was not associated with odds of eczema in children by 24 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	this itchy rash at any time in the last 12 months?" and "Has this itchy rash at any time affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears, or eyes?" In addition, physician-diagnosed atopic eczema was considered present if the child had been diagnosed by a physician as having atopic eczema at any time since birth.	• Intake of milk, yogurt, and cheese individually by quartile showed similar patterns of results, and all trends were NS. Physician-diagnosed atopic eczema • Total dairy products, P for trend=NS • Intake of milk, and cheese individually by quartile showed similar patterns of results, and trends were NS.	
Miyake, 2013[25] ***See Miyake, 2014[26]***	**Food(s) or Food Group(s):** Fish consumption by quartile, n=1,354 assessed once during pregnancy Meat consumption by quartile, n=1,354 assessed once during pregnancy (5-39 wk gestation) **Dietary assessment methods:** *See Miyake, 2014*[26] **Outcome:** Atopic Dermatitis: Eczema at ~24 mo **Outcome assessment methods:** *See Miyake, 2014*[26]	**Significant:** **Non-significant:** Eczema • Meat, P for trend=NS • Fish, P for trend=0.06 ○ Q1: Reference, Cases n=55 ○ Q2: Cases n=43, aOR=0.72, 95% CI: (0.46-1.12) ○ Q3: Cases n=63, aOR=1.18, 95% CI: (0.78-1.77) ○ Q4: Cases n=68, aOR=1.29, 95% CI: (0.86-1.93)	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, BW, HMF **OFCs accounted for:** Sex **Limitations:** Although the diet data were collected during pregnancy, there was a wide variability as to when the data was collected (range: 5-39 wk). • Outcome measurement was subjective and was reported by the participants, who were aware of the exposure. • Study was conducted in Japan, so the findings may not be entirely generalizable to the U.S. population. **Summary:** Higher maternal fish or meat intake during pregnancy was not associated with odds of eczema in children by 24 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings

Chatzi, 2013[5]; Greece & Spain
PCS, RHEA & INMA
 	
RHEA: Baseline N=1196
Analytic N=745
INMA: Baseline N=1784
Analytic N=1771
 	
RHEA: After excluding participants with induced abortions (n=51), those that had stillborn infants (n=2), incomplete reproductive outcomes data (n=32), 1196 were eligible to participate. Of those, participants with complete diet data (n=798) were included. The final sample size was further reduced to 745 after excluding those with implausible energy intake (n=53).
INMA: Mother-child pairs with a 1st trimester FFQ and data on infant respiratory outcomes included. Women with implausible values for total energy intake were excluded (n=13).
 	
• Age: 31.3 y
• Race/Ethnicity: NR
	Food(s) or Food Group(s):
	Mediterranean dietary pattern adherence
	• Low MD (Score: 0-3)
	• Medium MD (Score: 4-5)
	• High MD (Score: 6-8), indicating higher intakes of vegetables, legumes, fruits and nuts, cereals, fish and seafood, and dairy products, lower intakes of meat, and optimal MUFA:SFA ratio
	at 14–18 wk during pregnancy (~14.6 wk)
	
	Also examined outcomes by food/food group intake (by tertile): Fruits and nuts; Vegetables; Meat; Processed meat; Fish; Cereals; Dairy products
	
	Dietary assessment methods:
	RHEA: A semi-quantitative, validated, 250-item FFQ was administered during 14–18 wk gestation (~14.6 wk) assessing dietary habits over pregnancy. Photographs were used to visualize portion sizes. The intake frequency for each food item was converted to the average daily intake for each participant.
	
	INMA: A validated, 100-item FFQ was administered by trained interviewers to assess usual food and nutrient intakes during the first trimester of pregnancy
		Significant:
		
		Non-significant:
		Eczema
		• Mediterranean Diet
		  ○ Low MD: Reference
		  ○ Medium MD, P=NS
		  ○ High MD, P=NS
		• Fruits and nuts
		  ○ T2 vs T1, P=NS
		  ○ T3 vs T1, P=NS
		• Similarly, no association with intake of Vegetables; Meat; Processed meat; Fish; Cereals; Dairy products
		
		• Analyses were repeated with additional control for confounding by total energy intake and PA in pregnancy, dampness exposure during infancy and pet ownership, and the results remained essentially the same with the original analysis (data not shown).
			Key confounders accounted for:
			Age, SES, Smoking, Family history, HMF, (Pets)
			
			OFCs accounted for:
			Sex, (Indoor environment)
			
			Limitations:
			• Data from 2 cohorts were combined in this study and there were variabilities in both the exposure and the outcome assessments. In addition, the time point of outcome assessment was also different between the cohorts (~13.6mo (INMA) or ~9.4mo (RHEA)).
			• Potential selection bias, with children that were lost to follow-up were more likely a preterm or a LBW baby.
			• Although the outcome was doctor-reported eczema, it was still subjective and was reported by the participants, who were aware of the exposure.
			
			Summary:
			Greater adherence to a Mediterranean dietary pattern during pregnancy was not associated with risk of eczema in children at ~9.4-13.6 mo.
			
			Higher intake of fruits and nuts, vegetables, meat, processed meat, fish, cereals, dairy products was not associated with risk of eczema in children at ~9.4-13.6 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
• SES: ○ Maternal education ▪ Low: 22.4% ▪ Medium: 43.8% ▪ High: 33.8% • Characteristics reported but no test for differences by exposure ○ Smoking ○ Family history of eczema, asthma ○ GA ○ BW ○ HMF ○ Pet exposure	to capture intake from the last menstrual period until the time of the interview (~13.8 wk gestation). The intake frequency for each food item was converted to the average daily intake for each participant. MD adherence scored via EPIC methods. 1pt awarded for intake above the median for beneficial components (vegetables, legumes, fruits and nuts, cereals, fish and seafood, and dairy products), 1pt for intake below the median for detrimental components (meat, including all types of meat), and 1pt for optimal MUFA:SFA ratio. Otherwise, 0pt awarded for each component. Alcohol not included. Total score: 0-8. **Outcome:** Atopic Dermatitis: Eczema at ~13.6 mo (INMA) or ~9.4 mo (RHEA) **Outcome assessment methods:** Based on the ISAAC phase-I questionnaire: Eczema was defined as a positive answer to the question 'Has a doctor ever told you that your child has had atopic dermatitis/ eczema?'.		
Leermakers, 2013[13]; The Netherlands **PCS, Generation R**	**Food(s) or Food Group(s):** Total fish intake (g/wk) • 0: n=523 (Ref) • 1-69: n=728	**Significant:** **Non-significant:**	**Key confounders accounted for:** Age, Race/ethnicity, SES, Smoking, Family history, GA, BW, HMF, CFB timing, Pets

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings

Baseline N=2,969 Analytic N=2,796
 	
Of 3,433 Dutch mothers enrolled, 2969 included information about fish consumption. Exclusions included twin pregnancies (n=42) and missing child wheezing or eczema data (n=131), leaving 2796 for analysis.
 	
• Age: 31.8y
• Race/Ethnicity: NR (100% Dutch mothers)
• SES:
  ○ Maternal highest education completed
  ▪ Primary or secondary: 34.9%
  ▪ Higher: 65.1%
  ○ Household income (euro/mo)
  ▪ <2000: 15.3%
  ▪ ≥2000: 84.7%
• Characteristics reported but no test for differences by exposure
  ○ Smoking
  ○ Family history of asthma or atopy
  ○ GA
  ○ BW
  ○ HMF (any)
  ○ CFB timing
  ○ Pets
	• 70-139: n=908
	• 140-209: n=442
	• >210: n=195
	
	at 10.1-21.8 wk (~13.4 wk) during pregnancy
	
	Also examined outcomes by intake (g/wk) of: lean fish (4 levels), fatty fish (4 levels), and shellfish (3 levels)
	
	Dietary assessment methods:
	
	Dietary intake assessed at ~13.4 wk gestation using a validated, 293-item FFQ that covered dietary intake over the previous 3 months.
	
	Outcome: Atopic Dermatitis: Eczema
	
	at 1, 2, 3, and 4 y
	
	Outcome assessment methods:
	
	Doctor-attended eczema. Based on the ISAAC questionnaire: Doctor-attended eczema at age 1 refers to eczema between the ages 6 to 12 months.
		Eczema
		
		• Total Fish
		  ○ Age 1 y, P for trend=NS
		  ○ Similarly, no association with intake at age 2 y, 3 y, 4 y or overall risk of eczema
		
		• Similarly, no association with overall risk or risk of eczema at ages 1-4 y with intake of lean fish, fatty fish, or shellfish
			OFCs accounted for:
			
			Sex, Maternal alcohol use
			
			Limitations:
			
			• Although the outcome was 'doctor-attended eczema,' it was still self-reported.
			• Generalizability may be an issue, given than the study focused on 100% Dutch women.
			
			Summary:
			
			Higher intakes of total fish, lean fish, fatty fish, or shellfish during pregnancy were not associated with overall eczema risk and yearly risk at age 1-4 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Nguyen, 2017[27]; The Netherlands **PCS, Generation R** Baseline N=5,225 Analytic N=3600 • Age: Median=31.7 y, IQR=28.4–34.4 y • Race/Ethnicity: NR for mother • SES: Higher educational level: 52.7%, Household income ≥2200 Euros/mo: 61.2% • Other characteristics reported but no test for differences by exposure ○ Smoking ○ Family history of eczema, asthma ○ HMF ○ Animals/Pets/Farming exposure	**Food(s) or Food Group(s):** Diet Quality Score Higher diet quality included: • High intake of vegetables, fruit, whole grains, legumes, nuts, dairy, fish, and tea • High ratio whole grains to total grains and soft fats (i.e. soft margarines) and oils to total fat • Low intake of red meat, sugar-containing beverages, alcohol, and salt • Folic acid supplement use in early pregnancy **Dietary assessment methods:** Validated FFQ in early pregnancy (median 13.6 wks gestation (IQR=12.4–16.2wks). FFQ included foods frequently consumed in the Dutch population and was modified for use in pregnant women. Previously developed predefined food-based diet quality score was applied, reflecting adherence to Dutch dietary guidelines. Diet quality score included continuous scores on 15 components: vegetables, fruit, whole grains, legumes, nuts, dairy, fish, tea, ratio whole grains of total grains, ratio soft fats (i.e., soft margarines) and oils of total fat, red meat, sugar-containing beverages, alcohol, salt, and folic acid supplement use in early pregnancy. Maximum score for each component was 1, with an overall score ranging from 0 to 15. A	**Significant:** **Non-significant:** Risk of ever eczema at 10 y per 1 point higher diet quality score (n =3,600), P=NS Results of a sensitivity analysis were consistent with the main findings	**Key confounders accounted for:** SES, Smoking, Family history, HMF, Animals/pets/farming exposure, (race/ethnicity, only in a sensitivity analysis) **OFCs accounted for:** Child sex, Maternal substance use **Limitations:** • At least one key confounder not controlled for • Methods used to assess the exposure likely to result in minimal exposure misclassification • Proportions of and reasons for missing participants may differ across exposure groups and the analysis is unlikely to have removed the risk of bias arising from the missing data • Outcomes were subjective and assessed by participants, who were aware of the exposure received • Limited generalizability • No pre-registered data analysis plan **Summary:** Diet quality during pregnancy was not associated with risk of eczema in childhood.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	higher score represented better diet quality. **Outcome:** Eczema, asthma at 10 y **Outcome assessment methods:** Positive response to question "Was your child ever diagnosed by a physician with eczema/asthma?"		
Loo, 2017[15]; Singapore PCS, GUSTO Baseline N=735 Analytic N=620 (at 18 mo) and 576 (36 mo) • Age: NR • Race/Ethnicity: ○ Chinese: ~59% ○ Malay: ~26% ○ Indian: ~15% • SES: • Maternal Education: ○ <12y: ~38% ○ ≥12y college: ~62% • Reported but not tested by exposure: Family history, SES	**Food(s) or Food Group(s):** Dietary pattern adherence • VFR: Higher score indicated higher intakes of vegetables, fruit, and rice • SFN: Higher score indicated higher intakes of seafood and noodles • PCP: Higher score indicated higher intakes of pasta, cheese, and processed meat at 26-28wk during pregnancy **Dietary assessment methods:** Dietary intake was assessed at 26-28 weeks of pregnancy which was conducted by trained clinical staff with the use of the 5-stage multiple pass interviewing technique. Dietary patterns were derived by principal component extraction with Varimax rotation on the 68 food groups. Three factors (i.e. dietary patterns) were retained **Outcome:** Eczema at 18 mo and 3 y	**Significant:** **Non-significant:** All dietary patterns at 18 mo and 3 y, P=NS	**Key confounders accounted for:** SES, Family history, Race/ethnicity **OFCs accounted for:** Sex **Limitations:** • No information on potential co-exposures • Proportions of or reasons for missingness NR • Physician-diagnosis for eczema; women probably unaware of own dietary pattern. • Outcomes collected at 3, 6, 9, 12, 15, 18, 24, and 36 mo, but only 18, 36 mo reported because SPT data collected then • Although the outcome was based on diagnosed eczema, it was still self-reported • Mothers who participated in the study differed on the following characteristics from those that did not: race/ethnicity and maternal education levels • No pre-registered data analysis plan **Summary:** Maternal consumption of any dietary pattern during 26-28 wk pregnancy was not associated with risk of eczema in the child at 18 mo or 3 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Outcome assessment methods: Physician-diagnosed atopic eczema was based on a positive answer to the written question: "Has your child ever been diagnosed with eczema?"		
Jedrychowski, 2011[11]; U.S. & Poland **PCS** Baseline N=469 Analytic N=469 Of 505 women enrolled, 469 gave birth to term (>36 wk) infants. • Age: ~27.6 y • Race/Ethnicity: NR • SES: ○ Maternal education: ~15.7 y • Characteristics reported but no test for differences by exposure ○ Smoking (environmental) ○ Family history ○ GA ○ BW ○ HMF	**Food(s) or Food Group(s):** Total fish intake (g/wk) • ≤90: n=176 (Ref) • 91-205: n=168 • >205: n=125 in second and third trimester of pregnancy **Dietary assessment methods:** Dietary intake assessed during second and third trimester of pregnancy using an interviewer-administrated FFQ. In the course of the food interviews, detailed information on the eating frequency of smoked, fried, roasted and grilled fish servings was also collected. Maternal fish intake was categorized as follows: never; less than once per month; once per week; 1–2 times per week; 3–4 times per week, or every day. To estimate the total amount of fish eaten per week, it was assumed that each fish meal averaged 150 g. **Outcome:** Atopic Dermatitis: Eczema at any time during 3-12 mo **Outcome assessment methods:**	**Significant:** Eczema • Fish intake during pregnancy (g/wk), Logistic regression analysis ○ ≤90: References, Cases n=76 ○ 91-205: Cases n=69, OR=0.91, 95% CI: (0.59, 1.41), P=0.678 ○ >205: Cases n=38, OR=0.57, 95% CI: 0.35, 0.93), P=0.025 • Fish intake during pregnancy (g/wk), Poisson regression analysis ○ ≤90: References ○ 91-205: IRR=1.03, 95% CI: (0.78, 1.35), P=0.848 ○ >205: IRR=0.72, 95% CI: 0.52, 0.99), P=0.047 **Non-significant:**	**Key confounders accounted for:** Age, SES, Smoking, (Family history, only in logistic regression analysis), HMF, GA **OFCs accounted for:** Sex, Indoor environment **Limitations:** • Outcomes were subjective and were reported by the participants, who were aware of the exposure received • The study reported any eczema, but it is unclear if eczema at individual timepoints differed (Outcome was assessed at multiple time points (3, 6, 9, and 12 mo). • The study was conducted in New York City and Krakow, Poland. It is unclear if same/similar instruments were used and if the personnel were trained in a similar way. The comparability of the tools not specified (assuming that a translated tool was used in Poland). • Unclear if the FFQ was validated and the food items in the FFQ between the two sites were comparable. • The sample size and outcome incidence in New York City and Krakow was not specified. Other factors that might have influenced exposures and outcomes between the sites were not stated clearly.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	After delivery, a detailed, standardized, face-to-face interview on the infant's health was administered to each mother by a trained interviewer at each of the study periods 3, 6, 9 and 12 mo after birth. During the interview, a history of infantile eczema was recorded if the child experienced dry skin in combination with itchy rash and typical localization, which were confirmed by a physician.		**Summary:** The highest intake of fish, but not moderate intake, during pregnancy was associated with lower odds and cumulative frequency of eczema in children 3-12mo.
Shaheen, 2009[29]; U.K. PCS, ALSPAC Baseline N=12,008 Analytic N=9,516 • Age: ○ <25y: 21.4% ○ 25-29y: 39.2% ○ 30-34y: 29.1% ○ ≥35y: 10.3% • Race/Ethnicity ○ White: 96.3% ○ Non-White: 2.5% ○ Unknown: 1.1% • SES: ○ Maternal education: ▪ <O level: 29.3% ▪ O level: 34.7% ▪ A level+: 35.4% ○ Housing tenure: ▪ Owned/mortgaged: 73.8% ▪ Council rented: 12.1% ▪ Non-council rented: 8.0%	**Food(s) or Food Group(s):** Dietary pattern (Factor Analysis): • Health conscious pattern: High consumption of salad, fruit, fruit juices, rice, pasta, oat/bran based breakfast cereals, fish, pulses, cheese, and non-white bread. Low consumption of white bread. Traditional pattern: High consumption of potatoes (not chips), vegetables, red meat, and poultry. • Processed pattern: High consumption of meat pies, sausages, burgers, fried foods, pizza, chips, roast potatoes, white bread, eggs, and baked beans. Low consumption of non-white bread. • Confectionery pattern: High consumption of chocolate, sweets, biscuits, cakes/buns, puddings, and crisps. • Vegetarian pattern: High consumption of meat substitutes, pulses, nuts, and herbal tea. Low consumption of poultry and red meat. at 32 wk during <u>pregnancy</u>	**Significant:** **Non-significant:** Atopic dermatitis (Eczema) at 2.5y, n=9516 • Health conscious: P=0.08 • Traditional DP, P=NS • Processed DP, P=NS • Confectionary, P=NS • Vegetarian, P=NS Atopic dermatitis (Eczema) at 7.5y, n=7693 • Health conscious DP, P=NS • Traditional DP, P=NS • Processed DP, P=NS • Confectionary, P=NS • Vegetarian, P=NS	**Key confounders accounted for:** Age, Race/ethnicity, SES, Smoking, Family history, GA, BW, HMF, Animals/pets/farming exposure **OFCs accounted for:** Child sex, Indoor and outdoor environment **Limitations:** • At least one key confounder was not controlled for • Authors adjusted for post-exposure variables • FFQ was not formally validated, but was based on a validated FFQ • Proportions of missing participants differ substantially across exposures and the analysis is unlikely to have removed the risk of bias arising from the missing data • Majority of outcomes were subjective and the outcomes were assessed by participants, who were aware of the exposure received • No pre-registered data analysis plan **Summary:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
▪ Unknown/other: 6.1% ○ Financial difficulties: ▪ None: 35.8% ▪ Some: 38.0% ▪ Many: 25.7% ▪ Unknown: 0.5% • Characteristics reported with significant differences by exposure ○ Smoking ○ HMF • Characteristics reported but no differences by exposure ○ Family history ○ GA ○ BW ○ Animal/pets/farming exposure	**Dietary assessment methods:** 43-item FFQ at 32 wk gestation, based on FFQ validated in a British population. 5 dietary patterns were identified in the cohort using PCA: ‘‘health conscious’’, ‘‘traditional’’, ‘‘processed’’, ‘‘vegetarian’’ and ‘‘confectionery’’. DP scores were expressed in standard deviation units. Each mother was represented in each of these 5 mutually independent scores. **Outcome:** Atopic dermatitis (Eczema) **Outcome assessment methods:** The 12 mo prevalence of eczema at 2.5 y and 7.5 y defined by a positive response to the question: ‘‘Has your child had an itchy dry skin rash in joints and creases of his/her body (e.g., behind the knees, under the arms) since he/she was 18 months old?’’		Adherence to dietary patterns during pregnancy, identified using PCA, was not associated with childhood atopic dermatitis at 2.5 and 7.5 y of age.
Bédard, 2020[1]; U.K. PCS, ALSPAC Baseline N=8907 Analytic N=7705 • Age: ~28.9y • Race/Ethnicity:	**Food(s) or Food Group(s):** Mediterranean Diet (MD) Score adapted for pregnant women. • MD score 0-3: Lower adherence to a Mediterranean-style diet (n=3,475) • MD score 4-7: Greater adherence to a Mediterranean-style diet (n=5,432) Score based on the median weekly intake of 6 beneficial food groups	**Significant:** **Non-significant:** Eczema (n=7,705) • MD score 4-7 vs 0-3: P=NS • Per unit increase: P=NS	**Key confounders accounted for:** Age, Race/ethnicity, SES, Smoking, Family history, HMF **Limitations:** • At least one key confounder was not controlled for

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ White: ~98.2% ○ Non-White: ~1.8% • SES: ○ Mother's educational level: ▪ Certificate of Secondary Education: ~15.4% ▪ Vocational: ~9.0% ▪ Ordinary level: ~35.5% ▪ Advanced level: ~25.1% ▪ Degree: ~15.1% ○ Housing tenure: Owned/mortgaged: ~83.7% ○ Financial difficulties: ~17.1% • Characteristics reported with significant differences by exposure ○ Maternal age ○ Maternal educational level ○ Smoking ○ BW ○ HMF duration • Characteristics reported but no differences by exposure ○ Family history ○ GA ○ Race/ethnicity	(vegetables, legumes, fruits and nuts, cereal, fish and dairy) and 1 detrimental food group (meat). at 32 wk during pregnancy **Dietary assessment methods:** 43-item FFQ at 32wk gestation, based on one validated in a British population. Women whose consumption of beneficial food groups was above the median were assigned a value of 1, and those below were assigned a value of 0. For the detrimental food group, consumption below the median was assigned a value of 1, and above the median was assigned a value of 0. Food group values were summed together for a total ranging from 0 to 7, with a higher score representing greater adherence to a Mediterranean-style diet. **Outcome:** Atopic dermatitis at 7.5 y **Outcome assessment methods:** Eczema in children at 7.5y defined by a positive answer to the question: "Has your child had any of the following in the past 12 months: wheezing with whistling; eczema; hay fever?"		• FFQ was not formally calibrated against other instruments, but was based on one which has been validated • Important co-exposures imbalanced across groups that were likely to impact the outcome, and no adjustment techniques used to correct at least some of those variables • Outcome measurement was subjective and were assessed by participants, who were aware of the exposure received • Pre-registered data analysis NR **Summary:** Adherence to a Mediterranean-style diet during pregnancy was not associated with atopic dermatitis, in the child at 7.5 y.
Bertelsen, 2014[3]; Norway PCS, MoBa	**Food(s) or Food Group(s):** • Unexposed: No consumption of probiotic milk and yogurt, n=25,572 (63%)	**Significant:** Atopic eczema at 6mo: aRR: 0.94, 95%CI: 0.89-0.99	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF, Delivery mode

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Baseline N=40,614 Analytic N=40614 • Age: ○ <20-24y: 9% ○ ≥35y: 18% • Race/Ethnicity: NR • SES: ○ Single: 3% ○ Maternal Education: ▪ <High school: 6% ▪ >4y college: 23% • Reported but not tested by exposure: Smoking, Family history, BW, GA, Delivery mode, HMF	• Exposed: Maternal consumption of probiotic milk and yogurt n=15,042 (37%) during pregnancy (at 22 wk) **Dietary assessment methods:** Intake of milk-based probiotic products during pregnancy was recorded in the FFQ. The women were asked how often they consumed milk and yogurt, clearly distinguishing probiotic milk and yogurt from other milk items. Reported pregnancy consumption across all probiotic milk products was categorized into one dichotomous variable for any intake versus no intake and one 3-level variable based on intake in milliliters per day categorized as ‘‘none,’’ ‘‘13.0-28.3 mL/d,’’ and ‘‘>28.4 mL/d’’ **Outcome:** Atopic eczema at 6 mo Current atopic eczema at 18 mo **Outcome assessment methods:** Eczema was classified based on mothers’ responses to a question about ‘‘atopic eczema (childhood eczema)’’ asked on both the 6- and 18-month questionnaires.	Probiotic milk and yogurt consumption during pregnancy compared with no consumption during pregnancy was associated with a reduced risk of atopic eczema at 6mo Current atopic eczema at 18mo: Sensitivity analysis aRR: 1.08, 95% CI: 1.01, 1.15 Sensitivity analysis of maternal intake ONLY (not child) showed higher risk among exposed group **Non-Significant:** Atopic eczema at 6mo, P=NS Current atopic eczema at 18mo, P=NS • Sensitivity analysis of maternal AND child intake, P=NS • Sensitivity analyses, P=NS ○ Delivery mode, P=NS ○ Sex	**OFCs accounted for:** Child sex **Limitations:** • Based on the exposure data availability, only a sub-set of women from MoBa were included in this study. Mothers who participated in this study were different than the rest, on the following characteristics: education, smoking and parity • Outcome measurement was subjective and were assessed by participants, who were aware of the exposure received **Summary:** Maternal consumption of probiotic milk and yogurt during pregnancy was associated with lower risk of atopic eczema in the child at 6 mo, but not with current atopic eczema at 18 mo. In sensitivity analysis, maternal intake (when the infant received no probiotic milk) was associated with higher risk of current atopic eczema in the child at 18 mo. All other comparisons and sensitivity analyses revealed no association between maternal intake and child atopic eczema at 6mo or 18mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Bunyavanich, 2014[4]; U.S. PCS, Project Viva Baseline N=2128 Analytic N=1277 • Age: ~32.3 (from other Project Viva data) • Race/Ethnicity: White: 69% • SES: ○ Maternal Education: ○ ≥college graduate: 69.3% ○ Household income ≥$70K: 63.0% • Reported but not tested by exposure: Family history	**Food(s) or Food Group(s):** Maternal consumption of major food allergens (servings/d z scores) • Peanut: ○ 1st trimester: 0.34± 0.44 ○ 2nd trimester: 0.36± 0.43 • Milk: ○ 1st trimester: 1.16± 1.04 ○ 2nd trimester: 1.50± 1.82 • Wheat: ○ 1st trimester: 2.65± 1.48 ○ 2nd trimester: 2.69± 1.44 • Egg: ○ 1st trimester: 0.32± 0.30 ○ 2nd trimester: 0.33± 0.30 • Soy: ○ 1st trimester: 0.08± 0.27 ○ 2nd trimester: 0.08± 0.28 at 10 and 26-28 wk during pregnancy **Dietary assessment methods:** Maternal dietary assessments at the first and second trimester visits were based on a validated 166-item semi-quantitative FFQ modified for pregnancy. The total servings per day of each major food allergen (peanut, milk, wheat, egg, and soy) were calculated by summing the servings per day of the foods on the FFQ containing these respective food allergens. **Outcome:** Atopic dermatitis at ~7.9y	**Significant:** Maternal 2nd trimester wheat intake (per *z*-score): aOR=0.64, 95% CI: (0.46, 0.90) Stratification: Parental atopy Maternal 1st trimester milk intake (per *z*-score): aOR=0.64, 95% CI: (0.44, 0.96) **Non-significant:** Maternal 1st trimester intake of any food allergens, P=NS Maternal 2nd trimester intake of peanut, milk, egg, or soy, P=NS Stratification by parental atopy showed no association between intake of any food allergens during 1st or 2nd trimester (except 1st trimester milk with parental atopy).	**Key confounders accounted for:** (Race/Ethnicity adjusted in a secondary model), SES, Family history, HMF **OFCs accounted for:** Child sex **Limitations:** • Critical co-exposures NR • Mothers who participated in the study were different than those who were lost to follow-up on the following characteristics: maternal race, college education, income, parental atopy • Proportions of and reasons for missingness NR by exposure • Multiple exposure outcome comparisons were assessed without using an appropriate p-value correction • Self-reported exposure and outcome (for clinical symptoms) • Pre-registered data analysis plan NR **Summary:** Higher maternal consumption of wheat during the 2nd trimester of pregnancy was associated with reduced risk of atopic dermatitis in the child at 7.9y. Maternal intake of any major food allergens in the 1st trimester or of peanut, milk, egg, or soy in the 2nd trimester were not associated with risk of atopic dermatitis in the child at 7.9 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Outcome assessment methods: Current atopic dermatitis was defined as positive if a mother reported at the mid-childhood visit that her child ever had doctor-diagnosed eczema plus an itchy rash in the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears, or eyes in the past 12 months that did not go completely away for at least 6 mo. Ever atopic dermatitis were defined as positive if a mother reported a doctor's diagnosis of each respective condition in the child in any questionnaire since birth.		
Willers, 2007[31]; U.K. **PCS** Baseline N=1751 Analytic N=1212 Of 1751 women who completed FFQ during pregnancy, 1212 completed follow-up when children were 5y. • Age at recruitment: 29.9y, 95% CI: (29.6, 30.2) • Race/Ethnicity: NR • SES:	**Food(s) or Food Group(s):** Apple consumption by tertile • T1: 0-1/wk, n=398 • T2: 1-4/wk, n=427 • T3: >4/wk, n=384 at ~32 wk during pregnancy Fish consumption • Never, n=107 • <1/wk, n=255 • ≥1/wk, n=831 at ~32 wk during pregnancy Oily fish consumption • Never, n=629	**Significant:** Doctor-confirmed eczema • Fish intake, Cases n=380, P for trend=0.008 ○ Never: Ref ○ <1/wk: aOR=0.79, 95% CI: (0.47, 1.32) ○ ≥1/wk: aOR=0.57, 95% CI: (0.35, 0.92) Current eczema medication • Fish intake, Cases n=191, P for trend=0.028 ○ Never: Ref ○ <1/wk: aOR=0.88, 95% CI: (0.46, 1.67)	**Key confounders accounted for:** Age, SES, Smoking (Mother, Household), Family history, BW, HMF **OFCs accounted for:** Child sex **Limitations:** • Mothers who participated in the study were of higher SES and had slightly higher consumption of fruits, green leafy vegetables, whole grain products and fish. They also had fewer respiratory symptoms. • Multiple exposure outcome comparisons were assessed without using an appropriate p-value correction.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Partner from non-manual social class: 62.7% ○ Age left full time education: Median=18.5y, IQR=(16.0, 21.0) • Characteristics reported but no test for differences by exposure ○ Smoking ○ Family history ○ BW ○ HMF (Ever)	• <1/wk, n=414 • ≥1/wk, n=161 at ~32 wk during pregnancy **Dietary assessment methods:** Semi-quantitative, 150-item FFQ, divided into 20 food groups to capture intake over the previous 2-3mo. Responses were categorized as rarely or never, 1-2 times/mo, and separate categories for 1-7 d/wk. Food amounts were recorded as 1 to ≥5 measures per day. The number of measures/d was multiplied by the number of d/wk to obtain the total measures/wk. The food groups of interest in this study were total fruit, citrus/kiwi fruit, apples, total vegetables, green leafy vegetables, pure fruit juice, whole grain products, total fish, total oily fish, total fat from dairy products and exclusive butter versus margarine/low fat spread used as spread. The total number of measures per week was divided into tertiles for total fruit, citrus/kiwi fruit, apples, total vegetables, green leafy vegetables, pure fruit juice, whole grain products and into the categories never, less than once a week, and once or more a week for total fish and total oily fish. To facilitate extrapolation to the general population, subdivisions of food intakes into tertiles were derived from all of the women completing the FFQ and not merely those responding at 5 years.	○ ≥1/wk: aOR=0.58, 95% CI: (0.32, 1.06) **Non-significant:** Ever had eczema • Fish intake, Cases n=406, P for trend=0.050 ○ Never: Ref ○ <1/wk: aOR=0.91, 95% CI: (0.54, 1.53) ○ ≥1/wk: aOR=0.68, 95% CI: (0.43, 1.10) There were no consistent linear associations between maternal intake of total fruit, citrus/kiwi fruit, total vegetables, green leafy vegetables, fruit juice, whole grain products, fat from dairy products or butter versus margarine/low fat spread use and respiratory or atopic outcomes in children at 5 y, nor were there consistent associations between maternal intake of food groups and spirometry, atopic sensitization, bronchodilator response or exhaled nitric oxide.	**Summary:** Higher maternal fish intake was associated with lower odds of doctor-confirmed eczema and odds of current eczema medication in the child at 5y, but only marginally significantly associated with lower odds of ever having had eczema. Higher maternal oily fish intake was associated with lower odds of doctor-confirmed hay fever in the child at age 5 y, but was not associated with current hay fever medication or ever having had hay fever. No other foods or food group(s) measured were associated with respiratory or atopic outcomes.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Outcome: Asthma, Allergic dermatitis (eczema), Allergic rhinitis (hay fever) at 5 y **Outcome assessment methods:** Based on ISAAC core questions on symptoms of asthma, allergic rhinitis and atopic eczema, including the questions: ‘‘Has your child ever suffered from asthma?’’, ‘‘Has this been confirmed by a doctor?’’ and ‘‘Has your child received treatment for asthma in the past 12 months?” with similar questions enquired about eczema and hay fever.		
Pregnancy and Lactation			
Randomized Controlled Trials			
Fukushima, 1997[8]; Japan **RCT** Baseline N=350 Analytic N=283 • Age: NR • Race/Ethnicity: 100% from Japan • SES: NR • Significant differences by exposure (by design): HMF, CFB • No differences by exposure: Smoking, Family history, BW, Pets	**Food(s) or Food Group(s):** • CD: Mothers instructed to consume >200mL/d cow milk, n=140 randomized, n=127 analyzed • MD: Mothers instructed to consume >200 mL/d a casein-free, hypoallergenic formula and to avoid cow milk and reduce consumption of cow milk products, n=140 randomized, n=102 analyzed • AF: Mothers instructed to consume >200mL/d a casein-free, hypoallergenic formula and to avoid cow milk and reduce consumption of cow milk products, n=70 randomized, n=54 analyzed (Not randomized, no relevant comparisons included,	**Significant:** Eczema prevalence at 6mo, P<0.05 • MD (Ref): ~13% • CD: ~25% Eczema prevalence at 12mo, P<0.01 • MD (Ref): ~11% • CD: ~26% aOR=3.02, 95% CI: (1.44, 6.33) Eczema prevalence at 18mo, P<0.01 • MD (Ref): ~12% • CD: ~27% Eczema prevalence at 24mo, P<0.05 • MD (Ref): ~12%	**Key confounders accounted for:** Smoking, Family history, (CFB for aOR), Pets **OFCs accounted for:** None **Limitations:** • Randomization process NR • MD still consumed cow milk products, but had lower intake than CD • Attrition higher in MD group because women excluded from analysis if they consumed cow milk • Proportions of missing data seem to differ, reasons for missingness NR

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
~76% had a positive history of allergy (i.e. both parents or one parents or sibling only had history of allergies)	except as co-variates in logistic regressions) ○ Also supplemented with 1000 mg/d Ca during late pregnancy through end of lactation up to 6 mo postpartum From birth to 6 mo, the infants in the MD and CD groups were exclusively HMF or mixed-fed with breast milk and casein-free, hypoallergenic formula when breast milk was insufficient. The infants in the AF group were mixed-fed with breast milk and a formula with similar whey:casein ratio as breast milk for the corresponding 6mo. Infants who were fed breast milk exclusively from birth to 4mo were excluded from the AF group. **Dietary assessment methods:** Daily food diary from late pregnancy until 6 mo postpartum, recording the amount of casein-free, hypoallergenic formula, cow milk, cow milk products, eggs, meat, and soy products consumed. **Outcomes:** Atopic Dermatitis: Eczema at 6, 12, 18, and 24 mo Overall allergies (eczema, asthma, and/or allergic rhinitis) at 24 mo	• CD: ~23% aOR=2.12, 95% CI: (1.04, 4.31) Note, CD had significantly higher odds of overall allergies vs MD at 12mo, but due to inclusion of asthma these results to not meet NESR criteria **Non-significant:** Overall allergies at 24mo, P=NS • CD: aOR=1.75, 95% CI: (0.94, 3.25) • MD: (Ref) Note, odds of overall allergies NS at 6 and 18mo, but due to inclusion of asthma these results to not meet NESR criteria	• Participants were aware of exposure status and outcomes were self-reported • Eczema logistic regressions only reported at 12 and 24 mo, but data were collected at all 4 time points • Pre-registered data analysis plan NR **Summary:** Consuming diets replacing cow milk with casein-free hypoallergenic formula and reduced consumption of cow milk products from late pregnancy through lactation resulted in a lower risk of eczema in the child at 6, 12, 18, and 24 months.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Outcome assessment methods: Self-reported questionnaire. Specific allergies defined when symptoms chronically lasted for more than a few weeks. Atopic eczema defined as skin areas of scaly erythematous and itchy rash primarily involving the facial area, area behind the ears and flexural folds were present.		
Lovegrove, 1994[16]; U.K. **RCT** Baseline N=44 Analytic N=38 • Age: ~31y • Race/Ethnicity: NR • SES: 100% have partners • No differences by exposure: Family history (randomized groups only), HMF Women or her partner were atopic, defined as having eczema, asthma, hayfever and atopic dermatitis. Anecdotal symptoms were not accepted and only those who suffered from allergies that were clinically diagnosed were accepted as atopic.	**Food(s) or Food Group(s):** • Atopic: Mothers with diagnosed allergy or partner with diagnosed allergy encouraged to follow standard diets. Consumed ≥500 ml cows' milk daily, n=14 • Non-atopic: No allergy in mothers or partners. Mothers encouraged to follow standard diets (Not randomized, no relevant comparisons included), n=12 • Atopic-diet: Mothers with diagnosed allergy or partner with diagnosed allergy instructed to avoid all milk and dairy products. As a milk alternative, a hypoallergenic, complete infant formula, was given to the mothers to consume as required, n=12 ○ Also supplemented with 1000 mg/d Ca <u>from 36 wk gestation through lactation</u> All groups encouraged to practice	**Significant:** Eczema at 18 mo • Incidence, P<0.04 • Atopic (n=7) > Atopic-diet (n=4), **Non-significant:** Eczema at 6 mo • Incidence, P=NS • Severity, P=NS Eczema at 12 mo • Incidence, P=NS • Severity, P=NS Eczema at 18 mo • Severity, P=NS	**Key confounders accounted for:** Age, SES, Family history, HMF **OFCs accounted for:** Sex **Limitations:** • Randomization process NR • One pair of twins in non-atopic group, but this appears to be accounted for by the analyses • No differences in duration of HMF, but timing of first formula exposure Atopic (1mo) earlier than Atopic-diet (5mo), P<0.005 • Adherence appeared to be reasonable among those who completed, but 14% attrition is not explained and no appropriate analysis performed • Reasons for and proportions of missingness NR • Pre-registered data analysis NR **Summary:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	EHMF for 6 mo. Solid feeding discouraged until 3mo and started with baby rice and vegetables. Provision of cows' milk to the infant was discouraged until ≥6 mo. Other weaning practices performed at mother's discretion. **Dietary assessment methods:** 7 d weighed food inventory. Women following the restricted diet asked to record any dietary non-adherence. **Outcome:** Atopic Dermatitis: Eczema at 6, 12, and 18 mo **Outcome assessment methods:** Blinded doctor diagnosis Severity of eczema based on area and degree of skin irritation scaled from 1 to 3, with 1 indicating least severe allergy		Among mothers who were atopic or had atopic partners, consuming diets free of milk and dairy products from 36 weeks gestation through lactation resulted in a lower incidence of eczema in the child at 18 months, but not at 6 months or 12 months. There was no effect on severity of eczema in the child.
Zeiger, 1989[35]; U.S. **RCT** Baseline N=379 Analytic N=288 Power analysis: Yes Of these families, 14 in each group were found to be not	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation, n=212 ○ Cow milk-based whey infant formula provided for supplementation or weaning through 12mo postpartum. CFB encouraged: no solids <4mo, cereal at 4mo, followed by vegetables, fruits and egg yolks at	**Significant:** **Non-significant:** Period prevalence of atopic dermatitis, P=NS at each time point at 4, 12, and 24 mo • Atopic dermatitis (at 12mo, P=0.052)	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **Limitations:** • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
atopic, which eliminated them from the study Baseline characteristics for 288 participants • Age: ~28.6y • Race/Ethnicity: ○ Non-White: ~12.5% • SES: ○ Maternal occupation: white collar: ~54.0% ○ Family income <$20,000/y: ~9.7% ○ Maternal Education: ▪ ≤High school: ~13.6% • Characteristics reported with significant differences by exposure ○ BW (term, singletons) • Characteristics reported with no differences by exposure ○ Smoking ○ Family history ○ HMF ○ CFB ○ Animal/Pets/Farming exposure Families were included in the study if at least one parent met the following criteria: history of an atopic disorder and specific IgE by skin or RAST testing. Serum was obtained from the participants for total	6mo, meats at 8mo, and whole cow milk and egg whites at 12mo. • Prophylaxis: Instructed to avoid totally all milk (dairy), egg, and peanut products, avoid concentrated soy foods (i.e., tofu), ≤2 servings/d wheat, with other grains to fulfill cereal and starch requirements during 3rd trimester of pregnancy and lactation, n=167 ○ In addition to prenatal vitamins, the maternal diet was supplemented with a total of 1500 mg/d Ca. ○ A casein hydrolysate infant formula with low sensitization potential provided for supplementation or weaning through 12 mo postpartum. CFB encouraged: no solids <6mo, non-legume vegetables, followed by rice cereal at 7 mo, meats at 8mo, non-citrus fruits and juices at 9mo, and cow milk at 12 mo. Wheat, soy, corn, and citrus introduced thereafter at monthly intervals, followed by egg at 24 mo and peanuts and fish at 36 mo. • Both groups encouraged to feed human milk for ≥4-6 mo **Dietary assessment methods:** Women were randomly assigned to groups. In addition to instructions described above, women in prophylaxis group attended a dietary class was held before the 3rd trimester by a licensed dietitian to provide detailed	Cumulative prevalence of atopic dermatitis, P=NS at each time point at 4, 12, and 24mo • Atopic dermatitis (at 12mo, P=0.059)	• Rate of drop-out was significantly different in the prophylaxis vs. control groups (P<0.0001) • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups • Some missing data, but power calculation suggests the analytic N is sufficient to test hypotheses. • Physician making diagnosis was aware of exposure status; outcomes required both lab tests and observations at multiple time points, with similar results for "probable" and "definite" diagnoses. • No pre-registered data analysis plan. **Summary:** Maternal avoidance of milk (dairy), egg, and peanut products, concentrated soy foods, and limited intake of wheat during the 3rd trimester and lactation did not impact the incidence of atopic dermatitis in the child.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
and specific IgE determinations. Participant fathers were skin tested to inhalant antigens at the intake session. Mothers were skin tested to foods and inhalants 4 mo postpartum.	instructions on the maternal and infant diets, food lists, recipes, and product sources. Adherence to the dietary regimen was ascertained in part by maternal self-report and daily diaries. For both groups: 0.25 mg/d Tri-Vi-Flor given to infants according to their pediatrician's preference. Foods causing documented IgE sensitization were removed from the infant's diet until sensitization had waned or were tolerated on double-blind challenge. Parents received intensive education on reducing environmental allergens and tobacco smoke from their homes. **Outcome:** Atopic dermatitis, Allergic rhinitis, Food allergy at 1, 4, 8, and 12 mo **Outcome assessment methods:** Atopic dermatitis was defined as an eczematous eruption that met 3 (probable) or 4 (definite) of the following criteria: pruritus, typical morphology and distribution, a tendency toward chronicity or recurrence, and concurrent specific IgE at the time the rash was present		
Zeiger, 1992[36]; U.S. **RCT**	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation • Prophylaxis: Avoided all milk (dairy), egg, and peanut products,	**Significant:** **Non-Significant:** Period prevalence at 3 and 4 y:	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **Limitations:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Baseline N=379 Analytic N=242 (at 3 y) and 225 (at 4y) ***See Zeiger, 1989***[35]	concentrated soy foods (i.e., tofu), ≤2 servings/d wheat during 3rd trimester of pregnancy and lactation ○ Prenatal vitamins plus supplemented with a total of 1500 mg/d Ca Both groups encouraged to feed human milk for ≥4-6 mo **Outcome:** Atopic Dermatitis at 3 y and 4y Period prevalence: Defined as the proportion of subjects currently evidencing a measured parameter Cumulative prevalence: Defined as the proportion of subject evidencing the measured parameter at any past or current time Prophylactic infants used casein hydrolysate (Nutramigen) for supplementation or weaning, and avoided solid foods for 6 mo; cow milk, corn, soy, citrus, and wheat, for 12 mo; and egg, peanut, and fish, for 24 mo. Infants in the control groups Enfamil, a cow milk-based whey infant formula. Solid foods were introduced to control-group infants, based on AAP recommendations.	Prophylaxis vs Control: NS Cumulative prevalence: Prophylaxis vs, Control: NS	• More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers • Rate of drop-out was significantly different in the prophylaxis vs. control groups (p<0.0001) • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups • Some missing data, but power calculation suggests the analytic N is sufficient to test hypotheses. • Physician making diagnosis was aware of exposure status; outcomes required both lab tests and observations at multiple time points, with similar results for "probable" and "definite" diagnoses. • No pre-registered data analysis plan. **Summary:** There was no relationship between maternal diet and allergic rhinitis in the child, since both prophylaxis and control groups evidenced similar (cumulative and period) prevalence of allergic rhinitis.
Zeiger, 1995[34]**; U.S**	**Food(s) or Food Group(s):**	**Significant:**	**Key Confounders:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
RCT Baseline N=379 Analytic N=165 ***See Zeiger, 1989*[35]**	• Control (n=106): Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation • Prophylaxis (n=59): Avoided all milk (dairy), egg, and peanut products, concentrated soy foods (i.e., tofu), ≤2 servings/d wheat during 3rd trimester of pregnancy and lactation ○ Prenatal vitamins plus supplemented with a total of 1500 mg/d Ca Both groups encouraged to feed human milk for ≥4-6 mo **Outcome:** Atopic dermatitis: Eczema at 7 y of age Prophylactic infants used casein hydrolysate (Nutramigen) for supplementation or weaning, and avoided solid foods for 6 mo; cow milk, corn, soy, citrus, and wheat, for 12 mo; and egg, peanut, and fish, for 24 mo. Infants in the control groups Enfamil, a cow milk-based whey infant formula. Solid foods were introduced to control-group infants, based on AAP recommendations.	**Non-significant:** Atopic dermatitis • Period prevalence, P=NS • Cumulative prevalence, P=NS	Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **OFCs accounted for:** Sex **Limitations:** • Unclear if the participants that were lost to follow-up (since the baseline study) were any different than participants that completed the study . More participants were lost to follow up in the prophylaxis group than the control group • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers • Rate of drop-out was significantly different in the prophylaxis vs. control groups (p<0.0001). • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups **Summary:** Maternal avoidance of milk (dairy), egg, and peanut products, avoid concentrated soy foods, and limited

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
			intake of wheat during the 3rd trimester of pregnancy through lactation and reduced infant food allergen exposure during CFB did not affect the prevalence of food allergy in the child at 7 y, replicating previously reported findings at 3 y and 4y.
Non-Randomized Controlled Trials			
Herrmann, 1996[10]; Germany **NRCT** Baseline N=150 Analytic N=138 • Age: 30.5 • Race/Ethnicity: NR • SES: ○ Maternal Education: ▪ Low: ~26.8% ▪ Medium: ~17.3% ▪ High: ~56.0% • Characteristics reported with no differences by exposure ○ Family history ○ BW ○ HMF ○ CFB Women with a positive family history for atopic diseases (asthma, atopic eczema, allergic rhinitis) participated. Atopic heredity was	**Food(s) or Food Group(s):** • Group A: Diet free of any cow milk and egg protein in the third trimester of pregnancy and during the time of exclusive human milk feeding, n=30 • Group B: Diet free of any cow milk and egg protein from delivery through lactation, n=33 • Group C: Diet not restricted, n=41 • HF: Mothers from groups A-C who stopped or supplemented human milk feeding with hydrolysate formula, n=34 (Originally, 8 were in group A, 12 in group B and 14 in group C) All women recommended to adhere to a prudent diet rich in cereals, fresh fruits and vegetables. **Dietary assessment methods:** A history of food consumption (as an extended 24-h recall) and of general nutritional habits preceded the recommended nutritional changes. Information about possible product substitutes for milk and eggs along with recipes were given and motivationally discussed by the nutritionist. Mothers	**Significant:** **Non-significant:** Atopic dermatitis • Cumulative prevalence (0-12mo postpartum), P=NS ○ Group A: Cases n=6 ○ Group B: Cases n=6 ○ Group C: Cases n=5 • Prevalence 0-6mo postpartum, P=NS ○ Group A: Cases n=2 ○ Group B: Cases n=2 ○ Group C: Cases n=1 • Cumulative prevalence in HF group relative to intervention groups, P=0.095 HF: Cases n=10	**Key confounders accounted for:** Family history **OFCs accounted for:** None **Limitations:** • Adherence rates by group was NR, but the authors mention that only 67% of the participants were on a diet the entire time and it took 14 days for the “nutritional change” to become a habit. • History of atopic dermatitis was statistically different between certain groups (Group A vs. C, p<0.003). • Outcome assessors aware of the assigned interventions. **Summary:** Maternal avoidance of cow milk and egg protein during pregnancy and exclusive human milk feeding during lactation was not associated with prevalence of atopic dermatitis in the child during the first year of life (6 or 12 mo).

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
evaluated and infants from families with one of the first relative (i.e. parent or sibling) with atopy were included.	decided themselves which nutritional intervention they were ready to tolerate. **Outcome:** Atopic Dermatitis at 1, 3, 6, and 12 mo **Outcome assessment methods:** Infants were seen regularly by three pediatricians trained in atopy diagnosis at 1, 3, 6 and 12 mo. The parents underwent a structured interview regarding their infant's nutrition, diseases and relevant allergy signs and symptoms during the past period, with special emphasis placed on skin conditions in the infant's examinations. Atopic dermatitis defined as: a history of dry skin and at least three of the following typical morphological characteristics: pruritic dermatitis at typical sites, facial or extensor eczematous or lichenified dermatitis, periauricular fissures.		
Lactation			
Randomized Controlled Trials			

Jirapinyo, 2013[37]; Thailand
RCT
 	
Baseline N=62 Analytic N=62
 	
• Age: ~28.7y
• Race/Ethnicity: NR
	Food(s) or Food Group(s):
	• Control (n=32): liberal diets
	• No Dairy (n=30): dairy-restricted diet with 1 g/d Ca supplements
	from delivery until 4 mo postpartum
	
	Dietary assessment methods:
		Significant:
		Atopic dermatitis
		• at 4mo, P<0.05
		  ○ Control: Cases n=8 (25%)
		  ○ No Dairy: Cases n=2 (6.7%)
		
		Non-significant:
		Atopic dermatitis
			Key confounders accounted for:
			Age, Race/Ethnicity, Family history, BW, Delivery mode, HMF, CFB timing
			
			OFCs accounted for:
			Sex

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
• SES: NR • Other characteristics reported with no differences by exposure ○ Family history ○ BW ○ Delivery mode ○ HMF (100% exclusive) ○ CFB timing (none) All mothers were allergic	Women were randomly assigned to groups. In dairy-restricted group, authors educated mothers to restrict cows' milk and dairy products and foods containing cow milk protein. **Outcome: Atopic Dermatitis** at 7d, 1 mo, and 4 mo Outcome assessment methods: Examination for atopic dermatitis in infants was blindly performed by ≥2 investigators at 7 d, 1 mo, and 4 mo	• at 7d, P=NS • at 1mo, P=NS	**Limitations:** • Participants were not blinded. While the outcome assessors were blinded, it is unclear if the investigators were blinded. • It is unclear if adherence to the diet was assessed in intervention and control groups. • No published protocol. **Summary:** Consuming a dairy-restricted diet during the first 4 mo of lactation reduced the incidence of atopic dermatitis among infants at 4mo.

Table 4. Description of evidence on the relationship between maternal diet during pregnancy and lactation and risk of child allergic rhinitis[xiv, xv]

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Pregnancy			
Randomized Controlled Trials			
Falth-Magnusson, 1987[7]; Sweden, RCT Baseline N=212 Analytic N=181 Power calculation: Yes • Age: NR • Race/Ethnicity: NR • SES: NR • Significant differences by exposure: HMF, CFB • No differences by exposure: Smoking (infant exposure), Family history, BW, Animal/ Pets/Farming exposure All women had a personal history of allergy (asthma, rhinoconjunctivitis, and atopic eczema) or this was present in	**Food(s) or Food Groups(s):** • Non-Diet: Mothers encouraged to follow standard diets, n=108 randomized, 102 adhered and completed follow-up • Diet: Strictly milk- and egg-free diet, n=104, 79 adhered and completed follow-up ○ Supplemented with casein hydrolysate formula and Ca supplement for a total of 1200 mg/d Ca from 28wk through delivery Both groups encouraged to feed human milk By their own choice, many mothers limited milk and egg intake during lactation: at both 6wk and 3mo, D-true group had greater proportion of mothers with complete avoidance (P<0.05) or	**Significant**: **Non-Significant**: Probable rhinoconjunctivitis, P=NS	**Key confounders accounted for:** Family history, Animal/Pets/ Farming exposure **OFCs accounted for:** None **Limitations:** • Age at weaning: D-true (7.06mo), ND-true (5.98mo), P<0.005; Full or partial HMF at 6wk and 6mo, P=NS • Infant CM introduction by 6mo: D-true (55.1%), ND-true (81.2%), P<0.0005 • Unclear whether sex was balanced: D-true (32F, 47M), ND-true (40F, 62M) • One pair of twins included, not accounted for in analyses (group NR) • 3 infants born preterm, all in D group • ~50% of women adhered to casein hydrolysate

[xiv] ± indicates values of Mean± SD unless otherwise noted

[xv] AAP: American Academy of Pediatrics, ALSPAC: Avon Longitudinal Study of Parents and Children, aOR: adjusted odds ratio, aRR: adjusted risk ratio, BW: birth weight, CFB: complementary food and beverage, CI: confidence interval, d: day, DNBC: Danish National Birth Cohort, DP: dietary pattern, FFQ: food frequency questionnaire, GA: gestational age, GUSTO: Growing Up in Singapore Towards Healthy Outcomes, HMF: human milk feeding, IQR: interquartile range, ISAAC: International Study of Asthma and Allergies in Childhood, MD: Mediterranean diet, mo: month(s), MoBa: Mothers and Babies cohort, NR: not reported, NS: non-significant, OFCs: other factors considered, PCA: principal component analysis, PCS: prospective cohort study, PUFA: polyunsaturated fatty acid, RCT: randomized control trial, Ref: Reference, SES: socioeconomic status, SPT: skin prick test, T#: tertile, wk: week(s), y: year(s)

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
at least one of the family member (husband or child)	low intake of ≤2dL/wk milk and ≤2 eggs/wk (P<0.0001). Diet during lactation: Mothers that asked for information about diet during lactation were informed about a "low allergenic diet" regimen, allowing up to 2 dl of milk per day and two eggs per week. In the diet group, 10 mothers also continued to keep a strictly milk- and egg-free diet after delivery. The difference in consumption of these foods between the groups was statistically significant. **Outcome:** Probable rhinoconjunctivitis at 18mo **Outcome assessment methods:** All babies who demonstrated any signs and symptoms suggesting atopic disease or allergy before the age of 18 mo were examined by a senior pediatric allergist. The selection of examination was based on the information from the questionnaires, available case records, results of two skin prick tests and the result of a nurse visit at 18 mo. All babies demonstrating positive SPTs on any occasion were examined, as well as babies with a history of either otitis media, bronchitis, or pseudocroup on two or more occasions, and babies whose parents or the nurse had suspected eczema at any time. The aim of the physical examination at 18 mo		• Differences in HMF duration and CFB could have influenced the outcome • Attrition of 15% still left >180 participants required by estimate from power calculation • Lost to follow-up was higher in the D group than the ND group • No pre-registered data analysis plan **Summary:** Maternal avoidance of milk and eggs during 28wk gestation through delivery was not associated with probable rhinoconjunctivitis in the child at 18mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	was to score whether the child up to the age of that age had demonstrated definite, probable, possible, or no signs of atopic diseases. A question mark after atopic dermatitis points out that some but not all of the diagnostic features were present.		
Lilja, 1989[14]; Sweden **Cluster RCT** Baseline N=171 Analytic N=162 • Age: ~28.7y • Race/Ethnicity: NR • SES: NR • Characteristics reported with no difference by exposure ○ Smoking ○ Family history ○ HMF ○ CFB timing, types ○ Animal/Pets/Farming exposure Women in this study had a history of respiratory allergy symptoms after exposure to animal danders (cat and dog) and/or tree or grass pollens	**Food(s) or Food Group(s):** • High: Consumed "normal" amounts of hens' egg and cows' milk, n=83 • Reduced: Strictly reduced ingestion of egg and dairy products (milk, yogurt, butter, cheese, etc.), n=79 ○ Reduced A-Group: Women chose to continue reduced diet through 2mo postpartum (n=25) ○ Reduced B-Group: Women adhered to study design and stopped reduced diet after delivery (n=54) from 28wk gestation until delivery (until 2mo postpartum for A-Group) **Dietary assessment methods:** Women were randomly assigned to groups. In reduced group, no foods obviously containing egg or cows' milk were allowed, but small amounts of these foods, such as bread brushed with egg or ordinary margarines, were allowed. **Outcome:** Atopic disease: Atopic eczema	**Significant**: **Non-significant**: Rhinoconjunctivitis by 18mo • There were no significant differences between any groups (High, Reduced, A-Group, B-Group) in cumulative prevalence of obvious, probable, or possible rhinoconjunctivitis.	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **OFCs accounted for:** Child sex **Limitations:** • There was a **significant**ly higher incidence of atopic eczema and higher IgE levels before week 28 in the 'reduced' group. • Data <18mo measured but NR. • 4 pairs of twins included, but family relation is not accounted for in analyses. • Although a cluster RCT, it seems like the data analysis was conducted at the individual level. **Summary:** Higher (vs reduced) intake of egg and dairy products during pregnancy did not impact child's rhinoconjunctivitis risk at 18 mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Rhinoconjunctivitis at 2, 6, 12 and 18 mo **Outcome assessment methods:** All children were examined at 2, 6, 12, and 18 mo. The physicians who performed the physical examination at 18 mo were unaware of the mothers' diet during the trial and of previously performed SPT and in-vitro analyses in the mother and child. The cumulative incidence of signs of atopic diseases ≥18 mo was evaluated by a questionnaire and the physical examination into the following groups: obvious atopic, probable atopic, possible atopic, and the type of atopic symptom was noted.		
Prospective Cohort Studies			
Loo, 2017[15]; Singapore **PCS, GUSTO** Baseline N=735 Analytic N=620 (at 18 mo) and 576 (36 mo) • Age: NR • Race/Ethnicity: ○ Chinese: ~59% ○ Malay: ~26% ○ Indian: ~15% • SES: • Maternal Education: ○ <12 y: ~38% ○ ≥12 y college: ~62%	**Food(s) or Food Group(s):** Dietary pattern adherence • VFR: Higher score indicated higher intakes of vegetables, fruit, and rice • SFN: Higher score indicated higher intakes of seafood and noodles • PCP: Higher score indicated higher intakes of pasta, cheese, and processed meat at 26-28 wk gestation **Dietary assessment methods:** Dietary intake was assessed at 26-28 weeks of pregnancy which was conducted by trained clinical staff with the use of the 5-stage multiple pass	**Significant**: **Non-significant**: All dietary patterns at 18 mo and 3 y, P=NS	**Key confounders accounted for:** SES, Family history, Race/ethnicity **OFCs accounted for:** Sex **Limitations:** • At least one key confounder not adjusted for • No information on potential co-exposures • Proportions of or reasons for missingness NR • Physician-diagnosis for eczema; women probably unaware of own dietary pattern.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Reported but not tested by exposure: Family history, SES	interviewing technique. Dietary patterns were derived by principal component extraction with Varimax rotation on the 68 food groups. Three factors (i.e. dietary patterns) were retained **Outcome:** Rhinitis at 18 mo and 3 y **Outcome assessment methods:** "Rhinitis" was based on a positive response to the question "Has your child ever had sneezing, running nose, blocked or congested nose, snoring or noisy breathing during sleep or when awake that has lasted for 2 or more weeks duration?" Study team members called the participants who reported rhinitis to collect information on the number of episodes of rhinitis and the duration of each episode. A case prior to 18 mo required a single episode that lasted for at least 4 weeks or two or more episodes each lasting at least 2 weeks. New cases of rhinitis after 18 mo were defined by one or more episodes lasting at least 2 weeks.		• Outcomes collected at 3, 6, 9, 12, 15, 18, 24, and 36 mo, but only 18, 36 mo reported because SPT data collected then • Although the outcome was based on diagnosed eczema, it was still self-reported • Mothers who participated in the study differed on the following characteristics from those that did not: race/ethnicity and maternal education levels • Pre-registered data analysis plan NR **Summary:** Maternal consumption of any dietary pattern during 26-28 wk pregnancy was not associated with risk of rhinitis in the child at 18 mo or 3 y.
Shaheen, 2009[29]; U.K. PCS, ALSPAC Baseline N=12008 Analytic N=9516 • Age:	**Food(s) or Food Group(s):** Dietary pattern (Factor Analysis): • Health conscious pattern: High consumption of salad, fruit, fruit juices, rice, pasta, oat/bran based breakfast cereals, fish, pulses, cheese, and non-white bread. Low consumption of white bread.	**Significant**: **Non-significant**: Hay Fever (Allergic rhinitis) at 7.5y • Health conscious DP, P=NS • Traditional DP, P=NS • Processed DP, P=NS • Confectionary, P=NS	**Key confounders accounted for:** Age, Race/ethnicity, SES, Smoking, Family history, GA, BW, HMF, Animals/pets/farming exposure **OFCs accounted for:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ <25y: 21.4% ○ 25-29y: 39.2% ○ 30-34y: 29.1% ○ ≥35y: 10.3% • Race/Ethnicity ○ White: 96.3% ○ Non-White: 2.5% ○ Unknown: 1.1% • SES: ○ Maternal education: ▪ <O level: 29.3% ▪ O level: 34.7% ▪ A level+: 35.4% ○ Housing tenure: ▪ Owned/mortgaged: 73.8% ▪ Council rented: 12.1% ▪ Non-council rented: 8.0% ▪ Unknown/other: 6.1% ○ Financial difficulties: ▪ None: 35.8% ▪ Some: 38.0% ▪ Many: 25.7% ▪ Unknown: 0.5% • Characteristics reported with significant differences by exposure ○ Smoking ○ HMF • Characteristics reported but no differences by exposure ○ Family history ○ GA ○ BW Animal/pets/farming exposure	Traditional pattern: High consumption of potatoes (not chips), vegetables, red meat, and poultry. • Processed pattern: High consumption of meat pies, sausages, burgers, fried foods, pizza, chips, roast potatoes, white bread, eggs, and baked beans. Low consumption of non-white bread. • Confectionery pattern: High consumption of chocolate, sweets, biscuits, cakes/buns, puddings, and crisps. • Vegetarian pattern: High consumption of meat substitutes, pulses, nuts, and herbal tea. Low consumption of poultry and red meat. at 32wk gestation **Dietary assessment methods:** 43-item FFQ at 32 wk gestation, based on FFQ validated in a British population. 5 dietary patterns were identified in the cohort using PCA: ‘‘health conscious’’, ‘‘traditional’’, ‘‘processed’’, ‘‘vegetarian’’ and ‘‘confectionery’’. DP scores were expressed in standard deviation units. Each mother was represented in each of these 5 mutually independent scores. **Outcome:** Hay fever (Allergic Rhinitis) **Outcome assessment methods:** When the children were 7.5 y old the mothers were asked: ‘‘Has your child	• Vegetarian, P=NS	Child sex, Indoor and outdoor environment **Limitations:** • At least one key confounder was not controlled for • Authors adjusted for post-exposure variables • FFQ was not formally validated, but was based on a validated FFQ • Proportions of missing participants differ substantially across exposures and the analysis is unlikely to have removed the risk of bias arising from the missing data • Majority of outcomes were subjective and the outcomes were assessed by participants, who were aware of the exposure received • No pre-registered data analysis plan **Summary:** Greater adherence to dietary patterns during pregnancy, identified using PCA, was not associated with allergic rhinitis at 2.5 and 7.5 y of age.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	had any of the following in the past 12 months: wheezing; asthma; eczema; hay fever?		

Bédard, 2020[1]; U.K.
PCS: ALSPAC
 	
Baseline N=8907 Analytic N=7705
 	
• Age: ~28.9y
• Race/Ethnicity:
  ○ White: ~98.2%
  ○ Non-White: ~1.8%
• SES:
  ○ Mother's educational level:
  ▪ Certificate of Secondary Education: ~15.4%
  ▪ Vocational: ~9.0%
  ▪ Ordinary level: ~35.5%
  ▪ Advanced level: ~25.1%
  ▪ Degree: ~15.1%
  ○ Housing tenure: Owned/mortgaged: ~83.7%
  ○ Financial difficulties: ~17.1%
• Characteristics reported with significant differences by exposure
  ○ Maternal age
  ○ Maternal educational level
  ○ Smoking
  ○ BW
  ○ HMF duration
• Characteristics reported but no differences by exposure
  ○ Family history
  ○ GA
	Food(s) or Food Group(s):
	Mediterranean Diet Score adapted for pregnant women.
	• MD score 0-3: Lower adherence to a Mediterranean-style diet (n=3,475)
	• MD score 4-7: Higher adherence to a Mediterranean-style diet (n=5,432)
	Score based on the median weekly intake of 6 beneficial food groups (vegetables, legumes, fruits and nuts, cereal, fish and dairy) and 1 detrimental food group (meat).
	at 32 wk gestation
	
	Dietary assessment methods:
	43-item FFQ at 32wk gestation, based on one validated in a British population. Women whose consumption of beneficial food groups was above the median were assigned a value of 1, and those below were assigned a value of 0. For the detrimental food group, consumption below the median was assigned a value of 1, and above the median was assigned a value of 0. Food group values were summed together for a total ranging from 0 to 7, with a higher score representing greater adherence to a Mediterranean-style diet.
	
	Outcome: Allergic Rhinitis at 7.5 y
		Significant:
		
		Non-significant:
		• MD 4-7 vs 0-3: P=NS
		• Per unit increase: P=NS
			Key confounders accounted for:
			Age, Race/ethnicity, SES, Smoking, Family history, HMF
			
			Limitations:
			• At least one key confounder was not controlled for
			• FFQ was not formally calibrated against other instruments, but was based on one which has been validated
			• Important co-exposures imbalanced across groups that were likely to impact the outcome, and no adjustment techniques used to correct at least some of those variables
			• Outcome measurement was subjective and was assessed by participants, who were aware of the exposure received
			• Pre-registered data analysis NR
			
			Summary:
			Greater adherence to a Mediterranean-style diet during pregnancy was not associated with allergic rhinits in the child at 7.5 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Race/ethnicity	**Outcome assessment methods:** Hay fever in children at 7.5 y defined by a positive answer to the question: "Has your child had any of the following in the past 12 months: wheezing with whistling; eczema; hay fever?"		
Bertelsen, 2014[3]; Norway PCS, MoBa Baseline N=40614 Analytic N=40614 • Age: ○ <20-24y: 9% ○ ≥35y: 18% • Race/Ethnicity: NR • SES: ○ Single: 3% ○ Maternal Education: ▪ <High school: 6% ▪ >4y college: 23% Reported but not tested by exposure: Smoking, Family history, BW, GA, Delivery mode, HMF	**Food(s) or Food Group(s):** • Unexposed: No consumption of probiotic milk and yogurt, n=25,572 (63%) • Exposed: Maternal consumption of probiotic milk and yogurt n=15,042 (37%) during pregnancy (at 22 wk) **Dietary assessment methods:** Intake of milk-based probiotic products during pregnancy was recorded in the FFQ. The women were asked how often they consumed milk and yogurt, clearly distinguishing probiotic milk and yogurt from other milk items. Reported pregnancy consumption across all probiotic milk products was categorized into one dichotomous variable for any intake versus no intake and one 3-level variable based on intake in milliliters per day categorized as ‘‘none,’’ ‘‘13.0-28.3 mL/d,’’ and ‘‘>28.4 mL/d’’ **Outcome:**	**Significant**: Rhinoconjunctivitis • Unexposed: Ref • Exposed: aRR=0.87, 95% CI: (0.78, 0.98) • Sensitivity analysis, lower risk in exposed group ○ Maternal intake AND child intake ○ No maternal history or allergy/asthma ○ Vaginal delivery **Non-Significant**: • Sensitivity analyses, P=NS ○ Maternal intake ONLY, P=NS ○ Maternal history or allergy/asthma ○ Cesarean delivery ○ Sex	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF, Sex, Delivery mode **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not adjusted for • Based on the exposure data availability, only a sub-set of women from MoBa were included in this study. Mothers who participated in this study were different than the rest, on the following characteristics: education, smoking and parity • Outcome measurement was subjective and were assessed by participants, who were aware of the exposure received **Summary:** Maternal consumption of probiotic milk and yogurt during pregnancy was associated with lower risk of

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Rhinoconjunctivitis at 18-36 mo **Outcome assessment methods:** A child was classified as having rhinoconjunctivitis based on a mother's ''yes'' response to a question about ''allergy affecting eyes or nose, e.g., hay fever'' on the 36-month questionnaire		rhinoconjunctivitis in the child at 18-36 mo. Results from sensitivity analyses were mixed.
Bunyavanich, 2014[4]; U.S. PCS, Project Viva Baseline N=2128 Analytic N=1277 • Age: ~32.3 (from other Project Viva data) • Race/Ethnicity: White: 69% • SES: ○ Maternal Education: ○ ≥college graduate: 69.3% ○ Household income ≥$70K: 63.0% • Reported but not tested by exposure: Family history	**Food(s) or Food Group(s):** Maternal consumption of major food allergens (servings/d z scores) • Peanut: ○ 1st trimester: 0.34± 0.44 ○ 2nd trimester: 0.36± 0.43 • Milk: ○ 1st trimester: 1.16± 1.04 ○ 2nd trimester: 1.50± 1.82 • Wheat: ○ 1st trimester: 2.65± 1.48 ○ 2nd trimester: 2.69± 1.44 • Egg: ○ 1st trimester: 0.32± 0.30 ○ 2nd trimester: 0.33± 0.30 • Soy: ○ 1st trimester: 0.08± 0.27 ○ 2nd trimester: 0.08± 0.28 at 10wk and 26-28wk gestation **Dietary assessment methods:** Maternal dietary assessments at the first and second trimester visits were based on a validated 166-item semi-quantitative FFQ modified for	**Significant**: Maternal 1st trimester milk intake (per z score): aOR=0.85, 95% CI: (0.74, 0.97) Stratification: No parental atopy Maternal 1st trimester milk intake (per z score): aOR=0.76, 95% CI: (0.59, 0.99) **Non-significant**: Maternal 1st trimester intake of peanut, wheat, egg, or soy, P=NS Maternal 2nd trimester intake of any food allergens, P=NS Stratification by parental atopy showed no associated between intake of any food allergens during 1st or 2nd trimester (except 1st	**Key confounders accounted for:** (Race/Ethnicity adjusted in a secondary model), SES, Family history, HMF **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not adjusted for • Critical co-exposures NR • Mothers who participated in the study were different than those who were lost to follow-up on the following characteristics: maternal race, college education, income, parental atopy • Proportions of and reasons for missingness NR by exposure • Multiple exposure outcome comparisons were assessed without using an appropriate p-value correction • Self-reported exposure and outcome (for clinical symptoms)

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	pregnancy. The total servings per day of each major food allergen (peanut, milk, wheat, egg, and soy) were calculated by summing the servings per day of the foods on the FFQ containing these respective food allergens. **Outcome:** Allergic rhinitis at ~7.9y **Outcome assessment methods:** Current allergic rhinitis was defined as positive if a mother reported that her child had a runny nose or sneezing apart from colds in the past 12 mo. Ever allergic rhinitis, was defined as positive if a mother reported a doctor's diagnosis of each respective condition in the child in any questionnaire since birth.	trimester milk with no parental atopy) and allergic rhinitis.	• Pre-registered data analysis plan NR **Summary:** Higher maternal consumption of milk during the 1st trimester of pregnancy was associated with reduced risk of allergic rhinitis in the child at 7.9y. Maternal intake of peanut, wheat, egg, or soy in the 1st trimester or of any major food allergens in the 2nd trimester were not associated with risk of allergic rhinitis in the child at 7.9y.
Willers, 2007[31]; U.K. **PCS** Baseline N=1751 Analytic N=1212 Of 1751 women who completed FFQ during pregnancy, 1212 completed follow-up when children were 5y. • Age at recruitment: 29.9y, 95% CI: (29.6, 30.2) • Race/Ethnicity: NR	**Food(s) or Food Group(s):** Apple consumption by tertile • T1: 0-1/wk, n=398 • T2: 1-4/wk, n=427 • T3: >4/wk, n=384 at ~32wk gestation Fish consumption • Never, n=107 • <1/wk, n=255 • ≥1/wk, n=831 at ~32wk gestation	**Significant**: Doctor confirmed hay fever • Oily fish intake, Cases n=68, P for trend=0.043 ○ Never: Ref ○ <1/wk: aOR=0.66, 95% CI: (0.34, 1.28) ○ ≥1/wk: aOR=0.28, 95% CI: (0.06, 1.19) **Non-significant**: Current hay fever medication • Oily fish intake, Cases n=44, P for trend=NS	**Key confounders accounted for:** Age, SES, Smoking (Mother, Household), Family history, BW, HMF **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not adjusted for • Mothers who participated in the study were of higher SES and had slightly higher consumption of fruits, green

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
• SES: ○ Partner from non-manual social class: 62.7% ○ Age left full time education: Median=18.5y, IQR=(16.0, 21.0) • Characteristics reported but no test for differences by exposure ○ Smoking ○ Family history ○ BW ○ HMF (Ever)	Oily fish consumption • Never, n=629 • <1/wk, n=414 • ≥1/wk, n=161 at ~32wk gestation **Dietary assessment methods:** Semi-quantitative, 150-item FFQ, divided into 20 food groups to capture intake over the previous 2-3mo. Responses were categorized as rarely or never, 1-2 times/mo, and separate categories for 1-7 d/wk. Food amounts were recorded as 1 to ≥5 measures per day. The number of measures/d was multiplied by the number of d/wk to obtain the total measures/wk. The food groups of interest in this study were total fruit, citrus/kiwi fruit, apples, total vegetables, green leafy vegetables, pure fruit juice, whole grain products, total fish, total oily fish, total fat from dairy products and exclusive butter versus margarine/low fat spread used as spread. The total number of measures per week was divided into tertiles for total fruit, citrus/kiwi fruit, apples, total vegetables, green leafy vegetables, pure fruit juice, whole grain products and into the categories never, less than once a week, and once or more a week for total fish and total oily fish. To facilitate extrapolation to the general population, subdivisions of food intakes into tertiles were derived from all of the women completing the FFQ	Ever had hay fever • Oily fish intake, Cases n=111, P for trend=NS	leafy vegetables, whole grain products and fish. They also had fewer respiratory symptoms. • Multiple exposure outcome comparisons were assessed without using an appropriate p-value correction. **Summary:** Higher maternal oily fish intake was associated with lower odds of doctor-confirmed hay fever in the child at age 5y, but was not associated with current hay fever medication or ever having had hay fever.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	and not merely those responding at 5 years. **Outcomes:** Asthma, Allergic dermatitis (eczema), Allergic rhinitis (hay fever) at 5y **Outcome assessment methods:** Based on ISAAC core questions on symptoms of asthma, allergic rhinitis and atopic eczema, including the questions: ''Has your child ever suffered from asthma?'', ''Has this been confirmed by a doctor?'' and ''Has your child received treatment for asthma in the past 12 months?'' with similar questions enquired about eczema and hay fever.		
Maslova, 2012[17]; Denmark **PCS, DNBC** Baseline N=61,908 Analytic N=38,570 • Age: 29.0± 4.0y • Race/Ethnicity: NR • SES: ○ SES Position: High-level proficiencies: ~23% • Characteristics reported by exposure but unknown significance ○ Smoking ○ Family history ○ GA	**Food(s) or Food Group(s):** Peanut and pistachio intake Tree nut intake • Group 1: Never • Group 2: 1x/mo • Group 3: 1-3x/mo • Group 4: ≥1x/wk once at 25 wk gestation **Dietary assessment methods:** Peanut and nut intake was assessed during mid-pregnancy by using a validated 360-item semi-quantitative FFQ15 that covered intake in the past 4wk. Specific questions were asked about snack consumption in the past	**Significant**: Peanut and pistachio intake Ever prescribed allergic rhinitis (n=38,552), P for trend=0.001 • 1 time/mo vs Never (Ref): aOR=0.84, 95% CI=(0.75, 0.95) • 2-3 times/mo vs Never (Ref): aOR=0.83, 95% CI=(0.71, 0.96) • ≥1 time/wk vs Never (Ref): P=NS **Non-significant**: Peanut and pistachio intake Self-reported allergic rhinitis (n=38,552), P for trend=0.06 • ≥1 time/wk to 1 time/mo vs Never (Ref): P=NS	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF **OFCs accounted for:** None **Limitations:** • Total sample size in the text and table does not match. It is unclear why additional participants were dropped from the study • No differentiation between peanut and pistachio intake • Exposure does not include processed nut products

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ BW ○ HMF	month, separately assessing ‘‘peanut and pistachio’’ intake and the intake of ‘‘nuts and almonds.’’ We assumed that most women consumed peanuts rather than pistachios in the ‘‘peanut and pistachio’’ category. **Outcome:** Allergic rhinitis at 7 y based on ISAAC questionnaire and defined as self-reported doctor diagnosis of hay fever Ever prescribed allergic rhinitis defined as ≥2 anti-allergic prescriptions in the Register of Medicinal Product Statistics (RMPS) Allergic rhinitis cases based on combinations of anti-allergy drugs, except for antihistamines only once, eye drops only once, or nasal decongestants only once.	Tree nut intake Self-reported allergic rhinitis (n=38,223), P for trend=0.21 • ≥1 time/wk to 1 time/mo vs Never (Ref): P=NS Ever prescribed allergic rhinitis (n=38,494), P for trend=0.39 • ≥1 time/wk to 1 time/mo vs Never (Ref): P=NS	• At least one key confounder not adjusted for • No information on deviation from intended exposures • Critical co-exposures not accounted for in the analysis • Self-reported outcome measure only minimally influenced by knowledge of the exposure received by study participants • Potential selection bias, as participants that completed the study were significantly different than the non-participants on the following characteristics: SES, parity, and smoking status • No pre-registered data analysis plan **Summary:** Higher maternal peanut and pistachio intake during pregnancy was associated with a reduced risk of ever prescribed allergic rhinitis in childhood, compared with lower intake. Higher maternal tree nut intake during pregnancy was not associated with self-reported allergic rhinitis at 7 y.
Maslova, 2012[18]; Denmark PCS, DNBC Baseline N=61909 Analytic N=NR	**Food(s) or Food Group(s):** Total dairy product intake and total milk intake by glasses/d: • Group 1: >0 • Group 2: >1–2 • Group 3: >2–3 • Group 4: >3–4	**Significant**: Self-reported allergic rhinitis Low-fat yogurt intake (n=38,762), P for trend=NR >1 serving/d vs none: 1·40 (95 % CI 1·00, 1·97); P=NR	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF **OFCs accounted for:** Child sex

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
• Age: 21–39y: 98.0% • Race/Ethnicity: NR • SES Position: • High-level proficiencies: ~23% • Characteristics reported by exposure but unknown significance ○ Smoking (~25% with 13% current smokers) ○ Family history ○ GA ○ BW ○ HMF	• Group 5: >4–5 • Group 6: >5 Whole milk intake and semi-skimmed milk intake by frequency of consumption: • Group 1: Never • Group 2: 1x/mo • Group 3: 2.5x/mo • Group 4: 1.5–3.5x/wk • Group 5: ≥5.5x/wk Full-fat yogurt intake and low-fat yogurt intake by servings/d: • Group 1: 0 • Group 2: >0–0.5 • Group 3: >0.5–1 • Group 4: >1 **Dietary assessment:** A validated 360-item semi-quantitative FFQ was completed around gestation week 25; it referred to intake during the previous 4 weeks. Dairy product consumption was recorded in 8 questions in the FFQ; two of them asked about consumption of yogurt, in servings per day (including percentage of fat, with/without fruit) and 6 questions asked about milk consumption (whole milk, 1·5 % milk, 0·5 % milk, skimmed milk, churn buttermilk and chocolate milk) in glasses per day. The FFQ asked about yogurt with/without fruit to better estimate carbohydrates.	Further adjustment for other foods and nutrient intake did not change the results **Non-Significant**: Associations between total dairy product, total milk, whole milk, semi-skimmed milk, and full-fat yogurt and self-reported allergic rhinitis were NR.	**Limitations:** • At least one key confounder not controlled for • Selection into the study was related (but not very strongly) to exposure and outcome and this could not be adjusted for in analyses; • No information on deviation from intended exposures; • Self-reported outcome measure only minimally influenced by knowledge of the exposure received by study participants; • Potential selection bias, as participants that completed the study were significantly different than the non-participants on the following characteristics: SES, parity, and smoking status • Critical co-exposures not accounted for in the analysis • Possible selective reporting of the findings • No pre-registered data analysis plan **Summary:** Maternal low-fat yogurt intake during pregnancy increased the risk of self-reported allergic-rhinitis at 7 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Assuming that the serving sizes were approximately equal to 200 ml, the milk and yogurt variables were aggregated to obtain the frequency measures of total dairy intake. Frequency of milk intake was quantified by summing all types of milk and excluding yogurt. For our analyses, individual types of dairy product as well as total dairy product, total milk and total full-fat and low-fat yoghurt intake was examined. Once at 25 wk gestation **Outcome:** Allergic rhinitis at 7 y based on ISAAC questionnaire and defined as self-reported doctor diagnosis of hay fever		
Maslova, 2013[19]; Denmark **PCS, DNBC** Baseline N=28936 Analytic N=16867 • Age: ○ ≤20y: 0.7% ○ ≥40y: 1.2% • Race/Ethnicity: NR • SES: ○ SES Position: ○ High-level proficiencies: 22.9% ○ Medium-level proficiencies: 29.4% ○ Skilled: 24.5%	**Food(s) or Food Group(s):** Fish intake • Group 1: Never eating fish (~11%) • Group 2: Hot meal and sandwiches ≤1/mo (~25%) • Group 3: Hot meal 1/mo, sandwiches 1/wk (~37%) • Group 4: Hot meals 1/wk, sandwiches 1–2x/wk (~23%) • Group 5: Hot meals >2/wk, sandwiches >3x/wk (~4%) at 12 and 30 weeks (telephone interview that assessed fish intake with a sandwich or a hot meal) FFQ at 25 weeks also assessed fish intake in g/wk	**Significant**: Self-reported allergic rhinitis Fish intake (n=11,535), P for trend=0.01 • Group 4 vs Group 5 (Ref): P=NS • Group 3 vs Group 5 (Ref): aOR=0.73, 95% CI: (0.54, 0.97) • Group 2 vs Group 5 (Ref): aOR=0.68, 95% CI: (0.50, 0.94) • Group 1 vs Group 5 (Ref): P=NS **Non-significant**: Ever prescribed allergic rhinitis Fish intake (n=11,622), P for trend=0.85 Groups 2-5 vs Group 1 (Ref): P=NS	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not adjusted for • Selection into the analysis was related to exposure and may be related to outcome and this could not be adjusted for in the analyses • Participants tended to display healthier lifestyle habits and a higher SES compared to non-participants

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Unskilled: 10.6% ○ Students: 4.0% ○ Unemployed: 2.5% ○ Missing: 6.1% • Characteristics with significant differences by exposure ○ Smoking ○ BW ○ HMF • Characteristics with no differences by exposure • Family history ○ GA	**Dietary Assessment:** The FFQ asked about intake in the past 4 weeks and has been validated against 7 d food diaries and blood and urine biomarkers for selected nutrient (protein, retinol, folic acid and n-3 PUFA) and food (fruit and vegetable) intake. **Outcome:** Allergic rhinitis at 7 y based on ISAAC questionnaire and defined as self-reported doctor diagnosis of hay fever Ever prescribed allergic rhinitis defined as ≥2 anti-allergic prescriptions in the Register of Medicinal Product Statistics (RMPS)		• Critical co-exposures not accounted for in the analysis • Self-reported outcome measure only minimally influenced by knowledge of the exposure received by study participants • No pre-registered data analysis plan **Summary:** Maternal fish intake during pregnancy was not associated with risk of ever prescribed childhood allergic rhinitis. Lower maternal fish intake during pregnancy was associated with a reduced risk of self-reported childhood allergic rhinitis compared with higher fish intake.
Maslova, 2013[20]; Denmark **PCS, DNBC** Baseline N=60465 Analytic N=38398 • Age: ○ ≤20y: 1.0% ○ ≥40y: 0.9% • Race/Ethnicity: NR • SES: ○ SES Position: ○ High-level proficiencies: 20.6%	**Food(s) or Food Group(s):** Soft drink intake by frequency of intake • Artificially-sweetened carbonated ○ Group 1: Never: ~67% ○ Group 2: 1 serving/wk: ~13% ○ Group 3: 2-6 servings/wk: 16% ○ Group 4: ≥1 serving/d: ~4% • Artificially-sweetened non-carbonated ○ Group 1: Never: ~67% ○ Group 2: 1 serving/wk: ~7% ○ Group 3: 2-6 servings/wk: 13% ○ Group 4: ≥1 serving/d: ~13% • Sugar-sweetened carbonated ○ Group 1: Never: ~16% ○ Group 2: 1 serving/wk: ~26% ○ Group 3: 2-6 servings/wk: 48%	**Significant**: Self-reported allergic rhinitis Artificially-sweetened carbonated soft drink intake (n=37,971), P for trend=0.01 • Groups 2-4 vs Group 1 (Ref): P=NS **Non-significant**: Self-reported allergic rhinitis Artificially-sweetened non-carbonated soft drink intake (n=37,984), P for trend=0.83 • Group 1: Ref	**Key confounders accounted for:** Age, SES, Smoking, Family history, Delivery mode, HMF, Animals/pets/farming **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not accounted for • Participants tended to display healthier life-style habits compared to non-participants

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Medium-level proficiencies: 27.6% ○ Skilled: 24.1% ○ Unskilled: 11.3% ○ Students: 4.0% ○ Unemployed: 2.4% ○ Missing: 10.0% • Characteristics reported but no test for differences by exposure ○ Smoking ○ Family history ○ GA ○ BW ○ HMF	○ Group 4: ≥1 serving/d: ~10% • Sugar-sweetened non-carbonated ○ Group 1: Never: ~35% ○ Group 2: 1 serving/wk: ~15% ○ Group 3: 2-6 servings/wk: 28% ○ Group 4: ≥1 serving/d: ~22% assessed once at 25wk gestation **Dietary assessment:** Maternal diet assessment was based on a validated 360-item semi-quantitative FFQ completed around gestation week 25 and covered intake during the previous 4wk **Outcomes:** Allergic rhinitis at 7 y based on ISAAC questionnaire and defined as self-reported doctor diagnosis of hay fever Ever allergic rhinitis (N,38,000) by self-report was based on a reported doctor-diagnosis of hay fever	• Groups 2-4, P=NS Sugar-sweetened carbonated soft drink intake (n=38,111), P for trend=0.22 • Group 1: Ref • Groups 2-4, P=NS Sugar-sweetened non-carbonated soft drink intake (n=37,996), P for trend=0.72 • Group 1: Ref • Groups 2-4, P=NS	• No information on deviation from intended exposure • Critical co-exposures not accounted for in the analysis • Self-reported outcome measure only minimally influenced by knowledge of the exposure received by study participants • No pre-registered data analysis plan **Summary:** Higher maternal artificially-sweetened carbonated soft drink intake during pregnancy was significantly associated with a higher risk of self-reported childhood allergic rhinitis, compared with lower intake. Maternal sugar-sweetened soft drink consumption during pregnancy was not associated with risk of self-reported childhood allergic rhinitis.
Pregnancy and Lactation			
Randomized Controlled Trials			
Fukushima, 1997[8]; Japan **RCT** Baseline N=350 Analytic N=283 • Age: NR	**Food(s) or Food Group(s):** • CD: Mothers instructed to consume >200mL/d cow milk, n=140 randomized, n=127 analyzed • MD: Mothers instructed to consume >200mL/d a casein-free, hypoallergenic formula and to avoid cow milk and reduce consumption of	**Significant**: Note, CD had significantly higher odds of overall allergies vs MD at 12 mo, but due to inclusion of asthma as part of the outcome, these results do not meet the NESR criteria	**Key confounders accounted for:** Smoking, Family history, (CFB for aOR), Pets **OFCs accounted for:** None

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
• Race/Ethnicity: 100% from Japan • SES: NR • Significant differences by exposure (by design): HMF, CFB • No differences by exposure: Smoking, Family history, BW, Pets ~76% had a positive history of allergy (i.e. both parents or one parent or sibling only had history of allergies)	cow milk products, n=140 randomized, n=102 analyzed • AF: Mothers instructed to consume >200mL/d a casein-free, hypoallergenic formula and to avoid cow milk and reduce consumption of cow milk products, n=70 randomized, n=54 analyzed (Not randomized, no relevant comparisons included, except as co-variates in logistic regressions) ○ Also supplemented with 1000 mg/d Ca during late pregnancy through end of lactation up to 6mo postpartum From birth to 6mo, the infants in the MD and CD groups were exclusively HMF or mixed-fed with human milk and casein-free, hypoallergenic formula when human milk was insufficient. The infants in the AF group were mixed-fed with human milk and a formula with similar whey:casein ratio as human milk for the corresponding 6mo. Infants who were fed human milk exclusively from birth to 4 mo were excluded from the AF group. **Dietary assessment methods:** Daily food diary from late pregnancy until 6 mo postpartum, recording the amount of casein-free, hypoallergenic formula, cow milk, cow milk products, eggs, meat, and soy products consumed.	**Non-significant**: Allergic rhinitis at any age, P=NS Overall allergies at 24mo, P=NS • MD: (Ref) • CD: aOR=1.75, 95% CI: (0.94, 3.25) Note, odds of overall allergies NS at 6 and 18mo. However, due to inclusion of asthma these results do not meet the NESR criteria	**Limitations:** • Randomization process NR • MD still consumed cow milk products, but had lower intake than CD • Attrition higher in MD group because women excluded from analysis if they consumed cow milk • Proportions of missing data seem to differ, reasons for missingness NR • Participants were aware of exposure status and outcomes were self-reported • Eczema logistic regressions only reported at 12 and 24mo, but data were collected at all 4 time points • Pre-registered data analysis plan NR **Summary:** Consuming diets replacing cow milk with casein-free hypoallergenic formula with reduced consumption of cow milk products from late pregnancy through lactation did not impact overall allergies, including atopic eczema, asthma and allergic rhinitis.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Outcomes: Overall allergies (eczema, asthma, and/or allergic rhinitis) at 24 mo **Outcome assessment methods:** Self-reported by questionnaire. Specific allergies defined when symptoms chronically lasted for more than a few weeks. Allergic rhinitis was defined as clear water discharge from the nose.		
Zeiger, 1989[35]; U.S. **RCT** Baseline N=379 Analytic N=288 Power analysis: Yes Of these families, 14 in each group were found to be not atopic, which eliminated them from the study Baseline characteristics for 288 participants • Age: ~28.6y • Race/Ethnicity: ○ Non-White: ~12.5% • SES: ○ Maternal occupation: white collar: ~54.0% ○ Family income <$20,000/y: ~9.7%	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation, n=212 ○ Cow milk-based whey infant formula provided for supplementation or weaning through 12 mo postpartum. CFB encouraged: no solids <4 mo, cereal at 4 mo, followed by vegetables, fruits and egg yolks at 6 mo, meats at 8mo, and whole cow milk and egg whites at 12mo. • Prophylaxis: Instructed to avoid totally all milk (dairy), egg, and peanut products, avoid concentrated soy foods (i.e., tofu), ≤2 servings/d wheat, with other grains to fulfill cereal and starch requirements during 3rd trimester of pregnancy and lactation, n=167 ○ In addition to prenatal vitamins, the maternal diet was supplemented with a total of 1500 mg/d Ca.	**Significant**: **Non-significant**: Period prevalence of atopic disorders, P=NS at each time point at 4, 12, and 24mo • Allergic rhinitis Cumulative prevalence of atopic disorders, P=NS at each time point at 4, 12, and 24mo • Allergic rhinitis	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **Limitations:** • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Maternal Education: ▪ ≤High school: ~13.6% • Characteristics reported with significant differences by exposure ○ BW (term, singletons) • Characteristics reported with no differences by exposure ○ Smoking ○ Family history ○ HMF ○ CFB ○ Animal/Pets/Farming exposure Families were included in the study if at least one parent met the following criteria: history of an atopic disorder and specific IgE by skin or RAST testing. Serum was obtained from the participants for total and specific IgE determinations. Participant fathers were skin tested to inhalant antigens at the intake session. Mothers were skin tested to foods and inhalants 4mo postpartum.	○ A casein hydrolysate infant formula with low sensitization potential provided for supplementation or weaning through 12 mo postpartum. CFB encouraged: no solids <6 mo, non-legume vegetables, followed by rice cereal at 7 mo, meats at 8mo, non-citrus fruits and juices at 9mo, and cow milk at 12 mo. Wheat, soy, corn, and citrus introduced thereafter at monthly intervals, followed by egg at 24 mo and peanuts and fish at 36 mo. • Both groups encouraged to feed human milk for ≥4-6 mo **Dietary assessment methods:** Women were randomly assigned to groups. In addition to instructions described above, women in prophylaxis group attended a dietary class was held before the 3rd trimester by a licensed dietitian to provide detailed instructions on the maternal and infant diets, food lists, recipes, and product sources. Adherence to the dietary regimen was ascertained in part by maternal self-report and daily diaries. For both groups: 0.25 mg/d Tri-Vi-Flor given to infants according to their pediatrician's preference. Foods causing documented IgE sensitization were removed from the infant's diet until sensitization had waned or were tolerated on double-blind challenge. Parents received intensive education on		• Some missing data, but power calculation suggests the analytic N is sufficient to test hypotheses. • Physician making diagnosis was aware of exposure status; outcomes required both lab tests and observations at multiple time points, with similar results for • "probable" and "definite" diagnoses. • No pre-registered data analysis plan. **Summary:** There was no relationship between maternal diet and allergic rhinitis in the child.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	reducing environmental allergens and tobacco smoke from their homes. **Outcome:** Atopic dermatitis, Allergic rhinitis, Food allergy at 1, 4, 8, and 12mo **Outcome assessment methods:** Allergic rhinitis was defined as characteristic sneezing, itching, and/or rhinorrhea with existing specific IgE and nasal eosinophilia. Nasal eosinophils ≥1+ was considered definite, whereas 1/2+ was suggested as indicating probable allergic rhinitis. Prophylactic infants used casein hydrolysate (Nutramigen) for supplementation or weaning, and avoided solid foods for 6 mo; cow milk, corn, soy, citrus, and wheat, for 12 mo; and egg, peanut, and fish, for 24 mo. Infants in the control groups Enfamil, a cow milk-based whey infant formula. Solid foods were introduced to control-group infants, based on AAP recommendations.		
Zeiger, 1992[36]; U.S. **RCT** Baseline N=379 Analytic N=242 (at 3 y) and 225 (at 4y) ***See Zeiger, 1989[35]***	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation • Prophylaxis: Avoided all milk (dairy), egg, and peanut products, concentrated soy foods (i.e., tofu), ≤2 servings/d wheat during 3rd trimester of pregnancy and lactation	**Significant**: **Non-Significant**: Period prevalence at 3 and 4 y: Prophylaxis vs Control: NS Cumulative prevalence:	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **Limitations:** • More women in the prophylactic-treated group withdrew before delivery because of the protocol's

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	○ Prenatal vitamins plus supplemented with a total of 1500 mg/d Ca Both groups encouraged to feed human milk for ≥4-6 mo **Outcome:** Allergic Rhinitis at 3 y and 4 y Period prevalence: Defined as the proportion of participants currently evidencing a measured parameter Cumulative prevalence: Defined as the proportion of participants evidencing the measured parameter at any past or current time Prophylactic infants used casein hydrolysate (Nutramigen) for supplementation or weaning, and avoided solid foods for 6 mo; cow milk, corn, soy, citrus, and wheat, for 12 mo; and egg, peanut, and fish, for 24 mo. Infants in the control groups Enfamil, a cow milk-based whey infant formula. Solid foods were introduced to control-group infants, based on AAP recommendations.	Prophylaxis vs, Control: NS	dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers • Rate of drop-out was significantly different in the prophylaxis vs. control groups (p<0.0001) • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups • Some missing data, but power calculation suggests the analytic N is sufficient to test hypotheses. • Physician making diagnosis was aware of exposure status; outcomes required both lab tests and observations at multiple time points, with similar results for "probable" and "definite" diagnoses. • No pre-registered data analysis plan. **Summary:** There was no relationship between maternal diet and allergic rhinitis in the child, since both prophylaxis and control groups evidenced similar

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
			(cumulative and period) prevalence of allergic rhinitis.
Zeiger, 1995[34]; U.S. **RCT** Baseline N=379 Analytic N=165 ***See Zeiger, 1989*[35]**	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation, n=212 ○ Cow milk-based whey infant formula provided for supplementation or weaning through 12 mo postpartum. CFB encouraged: no solids <4mo, cereal at 4mo, followed by vegetables, fruits and egg yolks at 6mo, meats at 8mo, and whole cow milk and egg whites at 12mo. • Prophylaxis: Instructed to avoid totally all milk (dairy), egg, and peanut products, avoid concentrated soy foods (i.e., tofu), ≤2 servings/d wheat, with other grains to fulfill cereal and starch requirements during 3rd trimester of pregnancy and lactation, n=167 ○ In addition to prenatal vitamins, the maternal diet was supplemented with a total of 1500 mg/d Ca. ○ A casein hydrolysate infant formula with low sensitization potential provided for supplementation or weaning through 12 mo postpartum. CFB encouraged: no solids <6mo, non-legume vegetables, followed by rice cereal at 7 mo, meats at 8 mo, non-citrus fruits and juices at 9 mo, and cow milk at 12 mo. Wheat, soy, corn, and citrus introduced thereafter at monthly intervals, followed by egg	**Significant**: **Non-significant**: Period prevalence of allergic rhinitis, P=NS at 7 y Cumulative prevalence of atopic dermatitis, P=NS at 7 y	**Key confounders accounted for:** Age, Race/Ethnicity, SES, Smoking, Family history, HMF, CFB, Pets **Limitations:** • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers • Rate of drop-out was significantly different in the prophylaxis vs. control groups (p<0.0001) • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups • Some missing data, but power calculation suggests the analytic N is sufficient to test hypotheses.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	at 24 mo and peanuts and fish at 36 mo. • Both groups encouraged to feed human milk for ≥4-6 mo **Dietary assessment methods:** Women were randomly assigned to groups. In addition to instructions described above, women in prophylaxis group attended a dietary class was held before the 3rd trimester by a licensed dietitian to provide detailed instructions on the maternal and infant diets, food lists, recipes, and product sources. Adherence to the dietary regimen was ascertained in part by maternal self-report and daily diaries. For both groups: 0.25 mg/d Tri-Vi-Flor given to infants according to their pediatrician's preference. Foods causing documented IgE sensitization were removed from the infant's diet until sensitization had waned or were tolerated on double-blind challenge. Parents received intensive education on reducing environmental allergens and tobacco smoke from their homes. **Outcome:** Atopic dermatitis, Allergic rhinitis, Food allergy at 1, 4, 8, and 12 mo **Outcome assessment methods:** Allergic rhinitis was defined as a nasal condition with characteristic symptoms of sneezing, itching, and/or rhinorrhea		• Physician making diagnosis was aware of exposure status; outcomes required both lab tests and observations at multiple time points, with similar results for "probable" and "definite" diagnoses. • No pre-registered data analysis plan. **Summary:** Maternal avoidance of milk (dairy), egg, and peanut products, concentrated soy foods, and limited intake of wheat during the 3rd trimester and lactation did not impact the incidence of allergic rhinitis in the child.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	with concurrent specific IgE and nasal eosinophils (NEs)		

Table 5. Description of evidence on the relationship between maternal diet during pregnancy and lactation and risk of child asthma[xvi, xvii]

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Pregnancy			
Prospective Cohort Studies			
Shaheen, 2009[29]; U.K. PCS, ALSPAC Baseline N=12,008 Analytic N=9,516 • Age: ○ <25y: 21.4% ○ 25-29y: 39.2% ○ 30-34y: 29.1% ○ ≥35y: 10.3% • Race/Ethnicity ○ White: 96.3% ○ Non-White: 2.5% ○ Unknown: 1.1% • SES: ○ Maternal education: ▪ <O level: 29.3% ▪ O level: 34.7%	**Food(s) or Food Group(s):** Dietary pattern: • Health conscious pattern: High consumption of salad, fruit, fruit juices, rice, pasta, oat/bran based breakfast cereals, fish, pulses, cheese, and non-white bread. Low consumption of white bread. Traditional pattern: High consumption of potatoes (not chips), vegetables, red meat, and poultry. • Processed pattern: High consumption of meat pies, sausages, burgers, fried foods, pizza, chips, roast potatoes, white bread, eggs, and baked beans. Low consumption of non-white bread. • Confectionery pattern: High consumption of chocolate, sweets, biscuits, cakes/buns, puddings, and crisps.	**Significant:** **Non-significant:** Asthma at 7.5 y No association with any of the dietary patterns	**Key confounders accounted for:** Age, Race/ethnicity, SES, Smoking, Family history, GA, BW, HMF, Animals/pets/farming exposure **OFCs accounted for:** Child sex, Indoor and outdoor environment **Limitations:** • At least one key confounder was not controlled for • Authors adjusted for post-exposure variables • Start of follow up and exposure do not coincide and a potentially important amount of follow-up time is missing from analyses • FFQ was not formally validated, but was based on a validated FFQ • Proportions of missing participants differ substantially across exposures and the analysis is

[xvi] ± indicates values of Mean± SD unless otherwise noted

[xvii] AAP: American Academy of Pediatrics, ALSPAC: Avon Longitudinal Study of Parents and Children, aHR: adjusted hazard ratio, aOR: adjusted odds ratio, BW: birth weight, CFB: complementary food and beverage, CI: confidence interval, d: day, DGA: Dietary Guidelines for Americans, DIPP: Diabetes Prediction and Prevention Project, DNBC: Danish National Birth Cohort, DII: Dietary Inflammatory Index, DP: dietary pattern, FFQ: food frequency questionnaire, GA: gestational age, HEI: Healthy Eating Index, HMF: human milk feeding, IQR: interquartile range, ISAAC: International Study of Asthma and Allergies in Childhood, mo: month(s), MUFA: monounsaturated fatty acid, NR: not reported, NS: non-significant, OFCs: Other factors considered, PCA: principal component analysis, PCS: prospective cohort study, PIAMA: Prevention and Incidence of Asthma and Mite Allergy, PUFA: polyunsaturated fatty acid, Q#: quartile, RCT: randomized control trial, Ref: Reference, SD: standard deviation, SES: socioeconomic status, SFA: saturated fatty acid, T#: tertile, w: week(s), y: year(s)

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
▪ A level+: 35.4% ○ Housing tenure: ▪ Owned/mortgaged: 73.8% ▪ Council rented: 12.1% ▪ Non-council rented: 8.0% ▪ Unknown/other: 6.1% ○ Financial difficulties: ▪ None: 35.8% ▪ Some: 38.0% ▪ Many: 25.7% ▪ Unknown: 0.5% • Characteristics reported with significant differences by exposure ○ Smoking ○ HMF • Characteristics reported but no differences by exposure ○ Family history ○ GA ○ BW Animal/pets/farming exposure	• Vegetarian pattern: High consumption of meat substitutes, pulses, nuts, and herbal tea. Low consumption of poultry and red meat. at 32wk gestation **Dietary assessment methods:** 43-item FFQ at 32 wk gestation, based on FFQ validated in a British population. 5 dietary patterns were identified in the cohort using PCA: ‘‘health conscious’’, ‘‘traditional’’, ‘‘processed’’, ‘‘vegetarian’’ and ‘‘confectionery’’. DP scores were expressed in standard deviation units. Each mother was represented in each of these 5 mutually independent scores. **Outcome:** Asthma **Outcome assessment methods:** Children were defined as having current doctor-diagnosed asthma at 7.5 y (primary outcome of interest) if mothers responded positively to the question: ‘‘Has a doctor ever actually said that your study child has asthma?’’ and positively to one or both of the questions on wheezing and asthma in the past 12 mo		unlikely to have removed the risk of bias arising from the missing data • Majority of outcomes were subjective and the outcomes were assessed by participants, who were aware of the exposure received • No data analysis plan available **Summary:** Adherence to dietary patterns during pregnancy was not associated with childhood asthma at 7.5y.
Bédard, 2018[2]; U.K. **PCS: ALSPAC**	**Food(s) or Food Group(s):** Weekly intake of fresh fruits by quartile	**Significant:** **Non-significant:**	**Key confounders accounted for:** Age, Race/ethnicity, SES, Smoking, Family history, HMF

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings

Baseline N=8,915 Analytic N=7,677
 	
• Age: ~28.9y
• Race/Ethnicity:
  ○ White: ~98.2%
• SES:
  ○ Mother's educational level:
  ▪ Certificate of Secondary Education: ~15.4%
  ▪ Vocational: ~9.0%
  ▪ Ordinary level: ~35.5%
  ▪ Advanced level: ~25.1%
  ▪ Degree: ~15.1%
  ○ Housing tenure: Owned/mortgaged: ~83.7%
  ○ Financial difficulties: ~17.1%
• Baseline characteristics NR by exposure
	Weekly intake of vegetables by quartile
	once at 32 wk gestation
	
	Dietary assessment:
	Data on maternal diet in pregnancy were collected by a FFQ covering all the main foods consumed in Britain. The questionnaire included questions about the weekly frequency of consumption of 43 food groups and food items, with the possibility for respondents to tick one of the following options: never or rarely, once in 2 weeks, 1–3 times a week, 4–7 times a week, or more than once a day. One question on the weekly frequency of fresh fruit consumption and six questions on the weekly frequency of vegetables (peas, sweetcorn, broad beans; cabbage, brussels sprouts, kale and other green leafy vegetables; other green vegetables; carrots; other root vegetables; salad) were used to estimate weekly intake of fruits and vegetables, respectively, using standard portions.
	
	Outcome:
	Self-reported asthma at 7.5 y as positive response to the question "Has a doctor ever actually said that your study child has asthma?" and to one or both of the questions "Has your child had any of the following in the past 12 months: wheezing with whistling; asthma?"
		Fresh fruit intake (n=7,677)
		Q2-Q4 vs Q1 (Ref): P=NS
		P for trend=0.26
		
		Stratified by smoking status:
		• Non/passive smokers: P for trend=0.81
		• Active smokers: P for trend=0.16
		P for interaction=0.59
		
		Vegetable intake (n=6,117)
		Q2-Q4 vs Q1 (Ref): P=NS
		P for trend=0.22
		
		Stratified by smoking status:
		• Non/passive smokers: P for trend=0.91
		• Active smokers (OR): 0.88 (95% CI: 0.78, 1.00)
		P for trend=0.05
		P for interaction=0.18
			OFCs accounted for:
			Child Sex
			
			Limitations:
			• At least one key confounder was not controlled for
			• FFQ was not formally calibrated against other instruments, but was based on one which has been validated
			• Potential for selection bias as the participants included in the study were more likely to human milk feed, have higher education, less likely to have tobacco exposure, anxiety in pregnancy. Included participants are also more likely to be White.
			• Important co-exposures were not balanced across groups that were likely to impact the outcome, and no or inappropriate measurement and/or adjustment techniques were used to correct for the issues
			• Majority of outcomes were subjective and the outcomes were assessed by participants, who were aware of the exposure received
			• No data analysis plan available
			
			Summary:
			Maternal vegetable and fresh fruit intake during pregnancy was not associated with risk of childhood asthma at 7.5 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Bédard, 2020[1]; U.K. **PCS: ALSPAC** Baseline N=8,907 Analytic N=7,705 • Age: ~28.9y • Race/Ethnicity: ○ White: ~98.2% ○ Non-White: ~1.8% • SES: ○ Mother's educational level: ▪ Certificate of Secondary Education: ~15.4% ▪ Vocational: ~9.0% ▪ Ordinary level: ~35.5% ▪ Advanced level: ~25.1% ▪ Degree: ~15.1% ○ Housing tenure: Owned/mortgaged: ~83.7% ○ Financial difficulties: ~17.1% • Characteristics reported with significant differences by exposure ○ Maternal age ○ Maternal educational level ○ Smoking ○ BW ○ HMF duration • Characteristics reported but no differences by exposure	**Food(s) or Food Group(s):** Mediterranean Diet Score adapted for pregnant women. • MD score 0-3: Lower adherence to a Mediterranean-style diet (n=3,475) • MD score 4-7: Higher adherence to a Mediterranean-style diet (n=5,432) Score based on the median weekly intake of 6 beneficial food groups (vegetables, legumes, fruits and nuts, cereal, fish and dairy) and 1 detrimental food group (meat). at 32 wk gestation **Dietary assessment methods:** 43-item FFQ at 32 wk gestation, based on one validated in a British population. Women whose consumption of beneficial food groups was above the median were assigned a value of 1, and those below were assigned a value of 0. For the detrimental food group, consumption below the median was assigned a value of 1, and above the median was assigned a value of 0. Food group values were summed together for a total ranging from 0 to 7, with a higher score representing greater adherence to a Mediterranean-style diet. **Outcome:** Asthma at 7.5 y **Outcome assessment methods:**	**Significant:** **Non-significant:** Asthma (n=7,634) • MD score 4-7 vs 0-3: P=NS • Per unit increase: P=NS	**Key confounders accounted for:** Age, Race/ethnicity, SES, Smoking, Family history, HMF **Limitations:** • At least one key confounder was not controlled for • FFQ was not formally calibrated against other instruments, but was based on one which has been validated • Potential for selection bias as the participants included in the study were more likely to feed human milk, have higher education, less likely to have tobacco exposure, anxiety in pregnancy. Included participants are also more likely to be White. • Important co-exposures imbalanced across groups that were likely to impact the outcome, and no adjustment techniques used to correct at least some of those variables • Outcome measurement was subjective and were assessed by participants, who were aware of the exposure received • Pre-registered data analysis NR **Summary:** Adherence to a Mediterranean-style diet during pregnancy was not associated with asthma, in the child at 7.5 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Family history ○ GA ○ Race/ethnicity	Asthma defined in children at 7.5 y if mothers responded positively to the question "Has a doctor ever actually said that your study child has asthma?" and to one or both of the questions "Has your child had any of the following in the past 12 months: wheezing with whistling; asthma?"		
Bunyavanich, 2014[4]; U.S. PCS, Project Viva Baseline N=2,128 Analytic N=1,277 • Age: ~32.3 (from other Project Viva data) • Race/Ethnicity: White: 69% • SES: ○ Maternal Education: ○ ≥college graduate: 69.3% ○ Household income ≥$70K: 63.0% • Reported but not tested by exposure: Family history	**Food(s) or Food Group(s):** Maternal consumption of major food allergens (servings/d z scores) • Peanut: ○ 1st trimester: 0.34± 0.44 ○ 2nd trimester: 0.36± 0.43 • Milk: ○ 1st trimester: 1.16± 1.04 ○ 2nd trimester: 1.50± 1.82 • Wheat: ○ 1st trimester: 2.65± 1.48 ○ 2nd trimester: 2.69± 1.44 • Egg: ○ 1st trimester: 0.32± 0.30 ○ 2nd trimester: 0.33± 0.30 • Soy: ○ 1st trimester: 0.08± 0.27 ○ 2nd trimester: 0.08± 0.28 at 10 wk and 26-28 wk gestation **Dietary assessment methods:** Maternal dietary assessments at the first and second trimester visits were based on a validated 166-item semi-quantitative FFQ modified for pregnancy. The total servings per day of each major food allergen (peanut,	**Significant:** Maternal 1st trimester milk intake (per z score): aOR=0.83, 95% CI: (0.69, 0.99) **Non-significant:** Maternal 1st trimester intake of peanut, wheat, egg, or soy, P=NS Maternal 2nd trimester intake of any food allergens, P=NS Stratification by parental atopy showed no associated between intake of any food allergens during 1st or 2nd trimester and asthma.	**Key confounders accounted for:** (Race/Ethnicity adjusted in a secondary model), SES, Family history, HMF **OFCs accounted for:** Child sex **Limitations:** • Critical co-exposures NR • Mothers who participated in the study were different than those who were lost to follow-up on the following characteristics: maternal race, college education, income, parental atopy • Proportions of and reasons for missingness NR by exposure • Multiple exposure outcome comparisons were assessed without using an appropriate p-value correction • Self-reported exposure and outcome (for clinical symptoms) • Pre-registered data analysis plan NR **Summary:** Higher maternal consumption of milk during the 1st trimester of pregnancy was associated with reduced risk of asthma in the child at 7.9 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	milk, wheat, egg, and soy) were calculated by summing the servings per day of the foods on the FFQ containing these respective food allergens. **Outcome:** Asthma at ~7.9 y **Outcome assessment methods:** Current asthma was defined as positive if a mother reported at the mid-childhood visit that her child ever had doctor-diagnosed asthma plus either use of asthma medication or wheezing in the past 12 mo. Ever asthma was defined as positive if a mother reported a doctor's diagnosis of asthma in the child in any questionnaire since birth.		Maternal intake of peanut, wheat, egg, or soy in the 1st trimester or of any major food allergens in the 2nd trimester were not associated with risk of asthma in the child at 7.9 y.
Wright, 2018[33]; U.S. PCS, Project Viva Baseline N=1,068 Analytic N=1053 • Age: 32.5 ±5.0y • Race/Ethnicity (child): • White: 68% • SES: • College grad or higher: 71% • Household income >$70K: 62%	**Food(s) or Food Group(s):** Mean of 1st and 2nd trimester sugar-sweetened beverages (regular soda and fruit drinks) intake by quartile and continuous intake (servings/d) Q1: n=283 Q2: n=251 Q3: n=260 Q4: n=259 Mean of 1st and 2nd trimester fruit juice intake by quartile and continuous intake (servings/d) at ~11.9 wk and ~29.2 wk gestation	**Significant:** Sugar-sweetened beverages Q4 vs Q1: aOR=1.70, 95% CI: (1.08, 2.67) **Non-Significant:** Sugar-sweetened beverages Q2-Q3 vs Q1, P=NS Continuous intake, P=NS Juice intake (continuous or by quartile), P=NS	**Key confounders accounted for:** Race/ethnicity (child), SES, Smoking, Family history **OFCs accounted for:** Child Sex **Limitations:** • Not all confounders accounted for • Potential selection bias, as those included in the study were slightly older (mean, 32.5 vs 31.1 y), more likely to have graduated from college (71% vs 58%), have household income exceeding $70,000 compared to those who were not included • Adjusted for post-exposure variables

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
• Age, SES, and Smoking in pregnancy associated with sugar-sweetened beverage intake	**Dietary assessment:** Data on consumption of beverages during pregnancy from semi-quantitative FFQ was obtained from expectant mothers who completed it after the first and second research visits. Participants endorsed categories of frequency of beverage consumption from "never/less than one per month" to a maximum of "two or more glasses per day" for some fruit juices, "four or more cans per day" for soda, and "six or more glasses per day" for water. **Outcomes:** Current asthma defined as self-reported ever doctor-diagnosed asthma at ~7.7 y plus wheezing symptoms or asthma medications in the past year. Comparison group had no asthma diagnosis ever and no wheezing or asthma medication use in the past 12 mo.		• Proportions of and reasons for missingness NR by exposure • Self-reported, doctor-diagnosed outcomes • Pre-registered data analysis plan NR **Summary:** High maternal consumption of sugar-sweetened beverages averaged across the 1st and 2nd trimester of pregnancy was associated with increased odds of asthma in the child at 7.7 y, compared to low consumption. Lower levels of sugar-sweetened beverage intake and any level of juice intake during pregnancy was not associated with the odds of asthma in the child at 7.7 y.
Hanson, 2020[9]; U.S. PCS, Project Viva Baseline N=1,424 Analytic N=1,424 • Age: 32.3 ±5.0y • Race/Ethnicity: ○ White: 71% • SES: ○ College grad: 70%	**Food(s) or Food Group(s):** 1st trimester, 2nd trimester, and average of 1st and 2nd trimester. Dietary Inflammatory Index (DII) by quartile Q1: n=362 Q2: n=358 Q3: n=362 Q4: n=342 Higher quartiles of DII represent a more proinflammatory diet relative to lower quartiles at ~9.9 wk and ~29.9 wk gestation	**Significant:** **Non-significant:** No association between DII in 1st trimester, 2nd trimester, or average of 1st and 2nd trimesters and ever or current asthma in the child at 3.3y or 7.7y	**Key confounders accounted for:** Race/ethnicity, SES, Smoking, Family history **OFCs accounted for:** Child Sex **Limitations:** • Not all confounders accounted for 50% attrition; • Self-reported, doctor-diagnosed outcomes

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Household income >$70K: 64% • Reported with no differences by exposure: Smoking, Family history	**Dietary assessment:** The FFQ assessed dietary intake since the last menstrual period (first-trimester FFQ) or during the previous 3 mo (second-trimester FFQ). Resulting dietary data was used to calculate DII scores for each Participant. The 28 dietary parameters used for the DII calculation were energy, carbohydrate, protein, fat, alcohol, fiber, cholesterol, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, omega- 3 and omega-6 fatty acids, trans-fatty acids, niacin, thiamine, riboflavin, vitamin B12, vitamin B6, iron, magnesium, zinc, selenium, vitamin A, vitamin C, vitamin D, vitamin E, folic acid, and b-carotene **Outcomes:** Self-reported ever doctor-diagnosed asthma at ~3.3y and ~7.7y (mid childhood) **Outcome assessment methods:** For ever doctor-diagnosed asthma, the investigators asked the parent: “Have you ever been told by a health care professional, such as a doctor, physician assistant, or nurse practitioner, that your child has asthma?”		• Potential for selection bias, as those included in the study were slightly older (mean, 32.3 vs 30.8 years), more likely to have graduated from college (70% vs 52%), and White (71% vs 56%) compared to those who were not included • Pre-registered data analysis plan NR **Summary:** Maternal dietary inflammatory index during the 1st and/or 2nd trimester of pregnancy was not associated with risk of asthma in the child at 3.3 y or 7.7 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Mid-childhood current asthma was defined as ever doctor-diagnosed asthma plus wheezing symptoms or asthma medications in the past year. Participants with never asthma diagnosis, no wheezing, and no asthma medicines in the past year were used as the comparison group.		
Maslova, 2012[17]; Denmark **PCS, DNBC** Baseline N=61908 Analytic N=38570 • Age: 29.0± 4.0y • Race/Ethnicity: NR • SES: ○ SES Position: High-level proficiencies: ~23% • Characteristics reported by exposure but unknown significance ○ Smoking ○ Family history ○ GA ○ BW ○ HMF	**Food(s) or Food Group(s):** Peanut and pistachio intake Tree nut intake • Group 1: Never • Group 2: 1 time/mo • Group 3: 1-3 times/mo • Group 4: ≥1 time/wk **Dietary assessment methods:** Peanut and nut intake was assessed during mid-pregnancy by using a validated 360-item semi-quantitative FFQ15 that covered intake in the past 4wk. Specific questions were asked about snack consumption in the past month, separately assessing ‘‘peanut and pistachio’’ intake and the intake of ‘‘nuts and almonds.’’ We assumed that most women consumed peanuts rather than pistachios in the ‘‘peanut and pistachio’’ category. once at 25 wk gestation **Outcomes:**	**Significant:** Ever admitted asthma Peanut and pistachio intake (n=38,570), P for trend=0.002 • Group 2 vs Group 1 (Ref): P=NS • Group 3 vs Group 1 (Ref): aOR=0.82, 95% CI=(0.69, 0.97) • Group 4 vs Group 1 (Ref): aOR=0.66, 95% CI=(0.44, 0.98) Ever prescribed asthma Tree nut intake (n=38,494), P for trend=0.0003 • Group 2 vs Group 1 (Ref): aOR=0.91, 95% CI=(0.84, 0.98) • Group 3 vs Group 1 (Ref): P=NS • Group 4 vs Group 1 (Ref): aOR=0.81, 95% CI=(0.73, 0.90) **Non-significant:** Current asthma at 7 y Peanut and pistachio intake (n=13,443), P for trend=0.27	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF **OFCs accounted for:** None **Limitations:** • Total sample size in the text and table does not match. It is unclear why additional participants were dropped from the study • No differentiation between peanut and pistachio intake • Exposure does not include processed nut products • At least one key confounder not adjusted for • No information on deviation from intended exposures • Critical co-exposures not accounted for in the analysis • Self-reported outcome measure only minimally influenced by knowledge of the exposure received by study participants • Potential selection bias, as participants that completed the study were significantly different than the non-participants on the following characteristics: SES, parity, and smoking status

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Current asthma at 7y defined as self-reported doctor diagnosis of asthma plus wheeze in the past 12mo. **Outcome assessment methods:** Ever admitted asthma defined as first registered asthma diagnosis in the Danish National Patient Registry using International Classifications of Disease. Ever prescribed asthma defined as ≥2 asthma prescriptions in the Register of Medicinal Product Statistics (RMPS) except for b-2 agonists as liquid, inhaled b-2 agonists only once or inhaled steroid only once.	• Groups 2-4 vs Group 1 (Ref): P=NS Tree nut intake (n=13,415), P for trend=0.99 • Groups 2-4 vs Group 1 (Ref): P=NS Ever admitted asthma Tree nut intake (n=38,512), P for trend=0.19 • Groups 2-4 vs Group 1 (Ref): P=NS Ever prescribed asthma Peanut and pistachio intake (n=38,552), P for trend=0.29 • Groups 2-4 vs Group 1 (Ref): P=NS	• No pre-registered data analysis plan **Summary:** Higher maternal peanut and pistachio intake during pregnancy was associated with a reduced risk of ever admitted asthma in childhood, compared with lower intake. Higher maternal tree nut intake during pregnancy was associated with a reduced risk of ever prescribed asthma medication in childhood, compared with lower intake. Maternal peanut and pistachio intake, as well as tree nut intake, during pregnancy was not associated with current childhood asthma at 7 years.
Maslova, 2012[18]; Denmark **PCS, DNBC** Baseline N=61909 Analytic N=39058 • Age: 21–39y: 98.0% • Race/Ethnicity: NR • SES: ○ SES Position: High-level proficiencies: ~23%	**Food(s) or Food Group(s):** Total dairy product intake and total milk intake by glasses/d: • Group 1: >0 • Group 2: >1–2 • Group 3: >2–3 • Group 4: >3–4 • Group 5: >4–5 • Group 6: >5 Whole milk intake and semi-skimmed milk intake by frequency of consumption:	**Significant:** Ever admitted asthma • Low-fat yogurt intake (n=37,871), P for trend=0.03 ○ Group 2 vs Group 1 (Ref): P=NS ○ Group 3 vs Group 1 (Ref): aOR=1.20, 95% CI=(1.01, 1.42) ○ Group 4 vs Group 1 (Ref): P=NS Ever prescribed asthma: • Full-fat yogurt intake (n=39,002), P for trend=0.01	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not controlled for • Selection into the study was related (but not very strongly) to exposure and outcome and this could not be adjusted for in analyses;

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
• Characteristics reported by exposure but unknown significance ○ Smoking (~25% with 13% current smokers) ○ Family history ○ GA ○ BW ○ HMF	• Group 1: Never • Group 2: 1x/mo • Group 3: 2.5x/mo • Group 4: 1.5–3.5x/wk • Group 5: ≥5.5x/wk Full-fat yogurt intake and low-fat yogurt intake by servings/d: • Group 1: 0 • Group 2: >0–0.5 • Group 3: >0.5–1 • Group 4: >1 **Dietary assessment:** A validated 360-item semi-quantitative FFQ was completed around gestation week 25; it referred to intake during the previous 4 weeks. Dairy product consumption was recorded in 8 questions in the FFQ; two of them asked about consumption of yogurt, in servings per day (including percentage of fat, with/without fruit) and 6 questions asked about milk consumption (whole milk, 1·5 % milk, 0·5 % milk, skimmed milk, churn buttermilk and chocolate milk) in glasses per day. The FFQ asked about yogurt with/without fruit to better estimate carbohydrates. Assuming that the serving sizes were approximately equal to 200 ml, the milk and yogurt variables were aggregated to obtain the frequency measures of total dairy intake. Frequency of milk intake was quantified by summing all types of milk and excluding yogurt. For our analyses,	○ Group 2 vs Group 1 (Ref): aOR=0.87, 95% CI=(0.81, 0.93) ○ Groups 3-4 vs Group 1 (Ref): P=NS **Non-Significant:** Current Asthma • Total dairy product intake (n=13,635), P for trend=0.12 ○ Group 2 vs Group 1 (Ref): aOR=0.79, 95% CI=(0.62, 0.99) ○ Group 3 vs Group 1 (Ref): P=NS ○ Group 4 vs Group 1 (Ref): aOR= 0.73, 95% CI=(0.58, 0.92) ○ Groups 5-6 vs Group 1 (Ref): P=NS • Total milk intake (n=13,600), P for trend=0.10 ○ Groups 2-6 vs Group 1 (Ref): P=NS • Whole milk intake (n=13,324), P for trend=0.63 ○ Groups 2-5 vs Group 1 (Ref): P=NS • Semi-skimmed milk intake (n=13,285), P for trend=0.13 ○ Group 2 vs Group 1 (Ref): aOR=0.48, 95% CI=(0.26, 0.88) ○ Groups 3-5 vs Group 1 (Ref): P=NS • Full-fat yogurt intake (n=13,620), P for trend=0.20	• No information on deviation from intended exposures; • Self-reported outcome measure only minimally influenced by knowledge of the exposure received by study participants; • Potential selection bias, as participants that completed the study were significantly different than the non-participants on the following characteristics: SES, parity, and smoking status • Critical co-exposures not accounted for in the analysis • Possible selective reporting of the findings • No pre-registered data analysis plan **Summary:** Higher maternal low-fat yoghurt intake during pregnancy was associated with greater risk for ever admitted asthma, compared to lower intake. Higher maternal full-fat yoghurt intake during pregnancy was associated with reduced risk for ever prescribed asthma, compared to lower intake. Maternal total dairy product and milk intake during pregnancy was not associated with risk of childhood asthma.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	individual types of dairy product as well as total dairy product, total milk and total full-fat and low-fat yoghurt intake was examined. Once at 25wk gestation **Outcomes:** Current asthma at 7y defined as self-reported doctor diagnosis of asthma plus wheeze in the past 12mo. Ever admitted asthma defined as first registered asthma diagnosis in the Danish National Patient Registry using International Classifications of Disease. Ever prescribed asthma defined as ≥2 asthma prescriptions in the Register of Medicinal Product Statistics (RMPS) except for b-2 agonists as liquid, inhaled b-2 agonists only once or inhaled steroid only once.	○ Groups 2-4 vs Group 1 (Ref): P=NS ; • Low-fat yogurt intake (n=13,182), P for trend=0.06 ○ Groups 2-4 vs Group 1 (Ref): P=NS Ever admitted asthma: • Total dairy product intake (n=39,058), P for trend=0.56 ○ Groups 2-6 vs Group 1 (Ref): P=NS • Total milk intake (n=38,971), P for trend=0.68 ○ Groups 2-6 vs Group 1 (Ref): P=NS • Whole milk intake (n=38,285), P for trend=0.08 ○ Group 2 vs Group 1 (Ref): aOR=1.45, 95% CI=(1.05, 1.99) ○ Groups 3-5 vs Group 1 (Ref): P=NS • Semi-skimmed milk intake (n=38,175), P for trend=0.69 ○ Groups 2-5 vs Group 1 (Ref): P=NS • Full-fat yogurt intake (n=39,020), P for trend=0.48	

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
		○ Groups 2-4 vs Group 1 (Ref): P=NS Ever prescribed asthma: • Total dairy product intake (n=39,040), P for trend=0.46 ○ Groups 2-6 vs Group 1 (Ref): P=NS • Total milk intake (n=38,953), P for trend=0.26 ○ Groups 2-5 vs Group 1 (Ref): P=NS ○ Group 6 vs Group 1 (Ref): aOR=1.13, 95% CI=(1.02, 1.26) • Whole milk intake (n=38,267), P for trend=0.33 ○ Group 2 vs Group 1 (Ref): P=NS ○ Group 3 vs Group 1 (Ref): aOR=0.81, 95% CI=(0.68, 0.95) ○ Groups 4-5 vs Group 1 (Ref): P=NS • Semi-skimmed milk intake (n=38,158), P for trend=0.19 ○ Groups 2-5 vs Group 1 (Ref): P=NS • Low-fat yogurt intake (n=37,853), P for trend=0.15 ○ Group 2 vs Group 1 (Ref): aOR=1.07, 95% CI=(1.01, 1.14) ○ Group 3 vs Group 1 (Ref): P=NS ○ Groups 4 vs Group 1 (Ref): aOR=1.21, 95% CI=(1.02, 1.45)	

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Maslova, 2013[19]; Denmark PCS, DNBC Baseline N=28,936 Analytic N=16,867 • Age: ○ ≤20y: 0.7% ○ ≥40y: 1.2% • Race/Ethnicity: NR • SES: ○ SES Position: ▪ High-level proficiencies: 22.9% ▪ Medium-level proficiencies: 29.4% ▪ Skilled: 24.5% ▪ Unskilled: 10.6% ▪ Students: 4.0% ▪ Unemployed: 2.5% ▪ Missing: 6.1% • Characteristics with significant differences by exposure ○ Smoking ○ BW ○ HMF ○ Characteristics with no differences by exposure ○ Family history ○ GA	**Food(s) or Food Group(s):** Fish intake • Group 1: Never eating fish (~11%) • Group 2: Hot meal and sandwiches ≤1/mo (~25%) • Group 3: Hot meal 1/mo, sandwiches 1/wk (~37%) • Group 4: Hot meals 1/wk, sandwiches 1–2x/wk (~23%) • Group 5: Hot meals >2/wk, sandwiches >3x/wk (~4%) At 12 and 30 wk (telephone interview that assessed fish intake with a sandwich or a hot meal) FFQ at 25 weeks also assessed fish intake in g/wk **Dietary assessment:** The FFQ asked about intake in the past 4 weeks and has been validated against 7 d food diaries and blood and urine biomarkers for selected nutrient (protein, retinol, folic acid and n-3 PUFA) and food (fruit and vegetable) intake. **Outcomes:** Current asthma at 7 y defined as self-reported doctor diagnosis of asthma plus wheeze in the past 12 mo.	**Significant:** None **Non-significant:** Current asthma at 7y Fish intake (n=11,586), P for trend=0.75 • Groups 1-4 vs Group 5 (Ref): P=NS Ever admitted asthma Fish intake (n=11,631), P for trend=0.46 • Groups 1-4 vs Group 5 (Ref): P=NS Ever prescribed asthma Fish intake (n=11,622), P for trend=0.06 • Groups 2-4 vs Group 5 (Ref): P=NS • Group 1 vs Group 5: aOR=1.37, 95% CI: (1.10, 1.71), P=0.01	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not adjusted for • Selection into the analysis was related to exposure and may be related to outcome and this could not be adjusted for in the analyses • Participants tended to display healthier lifestyle habits and a higher SES compared to non-participants • Critical co-exposures not accounted for in the analysis • Self-reported outcome measure only minimally influenced by knowledge of the exposure received by study participants • No pre-registered data analysis plan **Summary:** Fish intake during pregnancy was not associated with risk of ever admitted asthma or current asthma at 7 years. Although P for trend was not significant, no fish intake during pregnancy was associated with a higher risk of ever prescribed asthma compared with high fish intake.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Ever admitted asthma defined as first registered asthma diagnosis in the Danish National Patient Registry using International Classifications of Disease. Ever prescribed asthma defined as ≥2 asthma prescriptions in the Register of Medicinal Product Statistics (RMPS) except for b-2 agonists as liquid, inhaled b-2 agonists only once or inhaled steroid only once.		
Maslova, 2013[20]; Denmark **PCS, DNBC** Baseline N=60465 Analytic N=38398 • Age: ○ ≤20y: 1.0% ○ ≥40y: 0.9% • Race/Ethnicity: NR • SES: ○ SES Position: ▪ High-level proficiencies: 20.6% ▪ Medium-level proficiencies: 27.6% ▪ Skilled: 24.1% ▪ Unskilled: 11.3% ▪ Students: 4.0% ▪ Unemployed: 2.4% ▪ Missing: 10.0% • Characteristics reported but no test for differences by exposure	**Food(s) or Food Group(s):** Soft drink intake by frequency of intake • Artificially-sweetened carbonated ○ Group 1: Never: ~67% ○ Group 2: 1 serving/wk: ~13% ○ Group 3: 2-6 servings/wk: 16% ○ Group 4: ≥1 serving/d: ~4% • Artificially-sweetened non-carbonated ○ Group 1: Never: ~67% ○ Group 2: 1 serving/wk: ~7% ○ Group 3: 2-6 servings/wk: 13% ○ Group 4: ≥1 serving/d: ~13% • Sugar-sweetened carbonated ○ Group 1: Never: ~16% ○ Group 2: 1 serving/wk: ~26% ○ Group 3: 2-6 servings/wk: 48% ○ Group 4: ≥1 serving/d: ~10% • Sugar-sweetened non-carbonated ○ Group 1: Never: ~35% ○ Group 2: 1 serving/wk: ~15% ○ Group 3: 2-6 servings/wk: 28% ○ Group 4: ≥1 serving/d: ~22% assessed once at 25 wk gestation	**Significant:** Ever prescribed asthma • Artificially-sweetened carbonated soft drink intake (n=38,258), P for trend=0.01 ○ Group 2 vs Group 1 (Ref): aOR=1.11, 95% CI: (1.02, 1.20) ○ Group 3 vs Group 1 (Ref): aOR=1.10, 95% CI: (1.02, 1.19) ○ Group 4 vs Group 1 (Ref): P=NS • Artificially-sweetened non-carbonated soft drink intake (n=38,272), P for trend=0.001 ○ Groups 2-3 vs Group 1 (Ref): P=NS ○ Group 4 vs Group 1 (Ref): aOR=1.15, 95% CI: (1.06, 1.25) **Non-significant:** Current asthma at 7y	**Key confounders accounted for:** Age, SES, Smoking, Family history, Delivery mode, HMF, Animals/pets/farming **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not controlled for • Participants tended to display healthier life-style habits compared to non-participants • No information on deviation from intended exposure • Critical co-exposures not accounted for in the analysis • Self-reported outcome measure only minimally influenced by knowledge of the exposure received by study participants • No pre-registered data analysis plan **Summary:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Smoking ○ Family history ○ GA ○ BW ○ HMF	**Dietary assessment:** Maternal diet assessment was based on a validated 360-item semi-quantitative FFQ completed around gestation week 25 and covered intake during the previous 4wk **Outcomes:** Current asthma at 7y defined as self-reported doctor diagnosis of asthma plus wheeze in the past 12mo. **Outcome assessment methods:** Ever admitted asthma defined as first registered asthma diagnosis in the Danish National Patient Registry using International Classifications of Disease. Ever prescribed asthma defined as ≥2 asthma prescriptions in the Register of Medicinal Product Statistics (RMPS) except for b-2 agonists as liquid, inhaled b-2 agonists only once or inhaled steroid only once.	• Artificially-sweetened carbonated soft drink intake and (n=38,149), P for trend=0.27 ○ Groups 2-4 vs Group 1 (Ref): P=NS • Similar results for artificially-sweetened non-carbonated soft drinks, sugar-sweetened carbonated soft drinks, and sugar-sweetened non-carbonated soft drinks Ever admitted asthma • Artificially-sweetened carbonated soft drink intake (n=38,258), P for trend=0.19 ○ Groups 2-3 vs Group 1 (Ref): P=NS ○ Group 4 vs Group 1 (Ref): aOR=1.30, 95% CI: (1.01, 1.66) • Artificially-sweetened non-carbonated soft drink intake (n=38,272), P for trend=0.08 ○ Groups 2-4 vs Group 1 (Ref): P=NS • Similar results for sugar-sweetened carbonated soft drinks and sugar-sweetened non-carbonated soft drinks (p for trend=0.05) Ever prescribed asthma • Sugar-sweetened carbonated soft drink intake (n=38,398), P for trend=0.72	Higher maternal artificially-sweetened carbonated and non-carbonated soft drink intake during pregnancy was associated with a higher risk of ever prescribed asthma in childhood, compared with lower intake. Although the P for trend was not significant, high maternal artificially-sweetened carbonated soft drink intake during pregnancy was associated with a higher risk of ever admitted asthma, compared with no intake. Sugar-sweetened soft drink consumption during pregnancy was not associated with risk of childhood asthma.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
		○ Groups 2-4 vs Group 1 (Ref): P=NS • Similar results for sugar-sweetened non-carbonated soft drinks (p for trend=0.07)	
Viljoen, 2018[30]; Ireland **PCS; Lifeways Cross-Generation** Baseline N=897 Analytic N=682 • Age at Delivery: <18y: 1.8%, ≥30y: 55.7% • Race/Ethnicity: 100% Irish-born • SES: 51.9% ≥tertiary education, 79.6% cohabiting, 14.8% eligible for free healthcare • Baseline characteristics that differed by exposure: ○ Age ○ SES ○ Smoking (for vegetable intake)	**Food(s) or Food Group(s):** • Vegetable intake (servings/d) • Oily fish intake (servings/d) assessed once during first trimester of pregnancy **Outcomes:** Doctor-diagnosed asthma over a 10 y follow-up period (assessed at ages 3, 5, and 9 y)	**Significant:** **Non-Significant:** Vegetable intake and risk of asthma over 10 y follow-up period (n=682) P=NS Oily fish intake and risk of asthma over 10 y follow-up period (n=678) P=NS	**Key confounders accounted for:** SES, Smoking, HMF practices, GA **OFCs accounted for:** None **Limitations:** At least one key confounder not controlled for ; Selection bias likely; Proportions of and reasons for missing participants may differ across exposure groups and the analysis is unlikely to have removed the risk of bias arising from the missing data ; No pre-registered data analysis plan; Suspected selective reporting **Summary:** Maternal vegetable intake and oily fish intake during pregnancy are not associated with risk of childhood asthma over the first 10 years.
Chen, 2020[6]; Ireland **PCS; Lifeways Cross-Generation**	**Food(s) or Food Group(s):** Healthy Eating Index (HEI-2015), higher score reflecting greater adherence to DGA assessed once during first trimester of pregnancy	**Significant:** HEI 2015 • Over 10y follow-up (n=862), per SD score increase of HEI-2015 ○ aOR=0.78, 95% CI=(0.64, 0.94), P<0.05	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF practices **OFCs accounted for:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Baseline N=862 Analytic N=862 • Age: 30.4± 5.8y • Race/Ethnicity: 100% Irish-born • SES: ○ 50.9% ≥tertiary education ○ 15.8% eligible for free healthcare • Baseline characteristics that differed by exposure: ○ Age ○ SES ○ Smoking	**Dietary assessment:** Mothers in the cohort completed a self-administered semi quantitative 149-item FFQ. The mothers indicated their average consumption frequency for each food item, ranging from "never or less than once per month" to "6+ per day," during the first 12–16 wk of pregnancy. The HEI-2015 scores a diet based on 9 adequacy components (intakes of total fruits; whole fruits; vegetables; greens and beans; total protein-containing foods; seafood and plant protein; whole grains; dairy; and ratio of PUFAs and MUFAs to SFAs) and 4 moderation components (refined grains, sodium, added sugars, and SFAs). The theoretical range of the HEI-2015 is 0–100, with a higher score reflecting greater adherence to recommendations in the dietary guideline for Americans (high intakes of foods counting toward adequacy components and low intakes of foods counting toward moderation components) and thus indicative of better dietary quality. For the adequacy components, a maximum score of 5, reflecting a higher intake, can be awarded for intakes of total fruits, whole fruits, vegetables, greens and beans, total protein-containing foods, and seafood and plant protein; the maximum score is 10 for consumption of whole grains, dairy, and fatty acids	• At 3y (n=677), per SD score increase ○ aOR=0.70, 95% CI=(0.52, 0.93), P<0.05 ○ Sensitivity analyses excluding improbable energy intakes did not change results • Over 10 y follow-up, per score quartile, P for trend=0.029 ○ Q2-Q4 vs Q1 (Ref): P=NS • At 3 y, per score quartile, P for trend=0.016 ○ Q2-Q3 vs Q1 (Ref): P=NS ○ Q4 vs Q1: P<0.05 (specific numbers only available for mutually adjusted model) DII • Over 10 y follow-up (n=862), per SD score increase of DII increase ○ aOR=1.34, 95% CI=(1.09, 1.64), P<0.01 ○ Sensitivity analyses excluding improbable energy intakes did not change results • At 3 y (n=677), per SD score increase ○ aOR=1.45, 95% CI=(1.05, 1.98), P<0.05 ○ Sensitivity analyses excluding improbable energy intakes did not change results	Child Sex, Maternal Alcohol Use, Indoor/Outdoor Environment **Limitations:** • At least one key confounder not controlled for • Adjusted for post-exposure variables • Selection into the analysis was related to exposure and outcome • Proportions of and reasons for missing participants may differ across exposure groups and the analysis is unlikely to have removed the risk of bias arising from the missing data • No pre-registered data analysis plan **Summary:** A maternal diet during pregnancy that is of lower quality is associated with a higher risk of childhood asthma over the first 10 y. A maternal diet during pregnancy that is of higher inflammatory potential is associated with a higher risk of childhood asthma over the first 10 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	ratio. All moderation components were subjected to reverse scoring and have a maximum score of 10, reflecting a lower intake. A higher E-DII score indicates a more proinflammatory diet. **Outcomes:** Doctor-diagnosed asthma in child over a 10-y follow-up (at ages 3, 5, and 9 y). **Outcome assessment methods:** At 3 y, doctors directly reported asthma diagnosis. At 5 y, information on doctor-diagnosed asthma was obtained through parental report. At 9 y, information on asthma diagnosis was obtained through both doctors' and parental reports.	• Sensitivity analysis excluding based on <500 or >3500 kcal/d ○ At 5 y (n=543), per SD score increase ○ aOR=1.44, 95% CI=(1.05, 1.98), P<0.05 • At 9 y (n=444), per SD score increase ○ aOR=1.43, 95% CI=(1.08, 1.89), P<0.05 ○ (Results similar for sensitivity analysis excluding based on <500 or >5000 kcal/d) • Over 10 y follow-up, per score quartile, P for trend=0.002 ○ Q2 vs Q1 (Ref): P=NS ○ Q3 vs Q1 (Ref): P<0.05 (specific numbers only available for mutually adjusted model) ○ Q4 vs Q1 (Ref): aOR=2.28, 95% CI=(1.30, 3.98) • At 3 y, per score quartile, P for trend=0.012 ○ Q2-Q4 vs Q1 (Ref): P<0.05 (specific numbers only available for mutually adjusted model) • At 9 y, per score quartile, P for trend=0.011 ○ Q2 vs Q1 (Ref): P=NS ○ Q3-Q4 vs Q1 (Ref): P<0.05 (specific numbers only available for mutually adjusted model)	

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
		Non-significant: HEI-2015 • At 5 y (n=543), per SD score increase, P=NS • At 9 y (n=444), per SD score increase, P=NS • Sensitivity analyses excluding improbable energy intakes did not change results • At 5 y, per score quartile, P for trend=0.42 ○ Q2-Q4 vs Q1 (Ref): P=NS • At 9 y, per score quartile, P for trend=0.50 ○ Q2-Q4 vs Q1 (Ref): P=NS DII: • At 5 y, per SD score increase, P=NS ○ Sensitivity analyses excluding based on <500 or >5000 kcal/d did not change results • At 9 y, per SD score increase, P=NS Association between E-DII score quartiles and doctor-diagnosed asthma: • At 5 y, per score quartile, P for trend=0.077 ○ Q2-Q4 vs Q1 (Ref): P=NS	

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Nguyen, 2017[27]; The Netherlands **PCS, Generation R** Baseline N= 5225 Analytic N= 3600 • Age: Median=31.7y, IQR=28.4–34.4y • Race/Ethnicity: NR for mother • SES: ○ Higher educational level: 52.7% ○ Household income ≥2200 Euros/mo: 61.2% • Other characteristics reported but no test for differences by exposure ○ Smoking ○ Family history of eczema, asthma ○ HMF ○ Animals/Pets/Farming exposure	**Food(s) or Food Group(s):** Diet Quality Score Higher diet quality included: • High intake of vegetables, fruit, whole grains, legumes, nuts, dairy, fish, and tea • High ratio whole grains to total grains and soft fats (i.e. soft margarines) and oils to total fat • Low intake of red meat, sugar-containing beverages, alcohol, and salt • Folic acid supplement use in early pregnancy **Dietary assessment methods:** Validated FFQ in early pregnancy (median 13.6 wks gestation (IQR=12.4–16.2 wks). FFQ included foods frequently consumed in the Dutch population and was modified for use in pregnant women. Previously developed predefined food-based diet quality score was applied, reflecting adherence to Dutch dietary guidelines. Diet quality score included continuous scores on 15 components: vegetables, fruit, whole grains, legumes, nuts, dairy, fish, tea, ratio whole grains of total grains, ratio soft fats (i.e., soft margarines) and oils of total fat, red meat, sugar-containing beverages, alcohol, salt, and folic acid supplement use in early pregnancy. Maximum score for each component was 1, with an overall score ranging	**Significant:** **Non-significant:** Risk of ever asthma at 10 y per 1 point higher diet quality score (n =3,610), P=NS Results of a sensitivity analysis were consistent with the main findings	**Key confounders accounted for:** SES, Smoking, Family history, HMF, Animals/pets/farming exposure, (race/ethnicity, only in a sensitivity analysis) **OFCs accounted for:** Child sex, Maternal substance use **Limitations:** • Limited generalizability • At least one key confounder not controlled for • Methods used to assess the exposure likely to result in minimal exposure misclassification • Proportions of and reasons for missing participants may differ across exposure groups and the analysis is unlikely to have removed the risk of bias arising from the missing data • Outcomes were subjective and assessed by participants, who were aware of the exposure received • No pre-registered data analysis plan **Summary:** Diet quality during pregnancy was not associated with risk of asthma in childhood.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	from 0 to 15. A higher score represented better diet quality. **Outcome:** Eczema, asthma at 10 y **Outcome assessment methods:** Positive response to question "Was your child ever diagnosed by a physician with eczema/asthma?"		
Bertelsen, 2014[3]; Norway **PCS, MoBa** **Baseline N=40614 Analytic N=40614** • Age: ○ <20-24y: 9% ○ ≥35y: 18% • Race/Ethnicity: NR • SES: ○ Single: 3% ○ Maternal Education: ▪ <High school: 6% ▪ >4y college: 23% • Reported but not tested by exposure: Smoking, Family history, BW, GA, Delivery mode, HMF	**Food(s) or Food Group(s):** • Unexposed: No consumption of probiotic milk and yogurt, n=25,572 (63%) • Exposed: Maternal consumption of probiotic milk and yogurt n=15,042 (37%) during pregnancy (at 22 wk) **Dietary assessment methods:** Intake of milk-based probiotic products during pregnancy was recorded in the FFQ. The women were asked how often they consumed milk and yogurt, clearly distinguishing probiotic milk and yogurt from other milk items. Reported pregnancy consumption across all probiotic milk products was categorized into one dichotomous variable for any intake versus no intake and one 3-level variable based on intake in milliliters per	**Significant:** **Non-Significant:** Asthma at 36 mo, P=NS • Sensitivity analyses, P=NS ○ Maternal intake ONLY ○ Maternal AND child intake ○ Maternal history of allergy/asthma (Yes, No) ○ Delivery mode ○ Sex	**Key confounders accounted for:** Age, SES, Smoking, Family history, HMF, Delivery mode **OFCs accounted for:** Child sex **Limitations:** • Based on the exposure data availability, only a sub-set of women from MoBa were included in this study. Mothers who participated in this study were different than the rest, on the following characteristics: education, smoking and parity • Outcome measurement was subjective and were assessed by participants, who were aware of the exposure received **Summary:** Maternal consumption of probiotic milk and yogurt during pregnancy was not associated with risk of current asthma with asthma medication in the child at 36mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	day categorized as ‘‘none,’’ ‘‘13.0-28.3 mL/d,’’ and ‘‘>28.4 mL/d’’ **Outcome:** Current asthma at 36 mo with asthma medication		
Willers, 2007[31]; U.K. **PCS** Baseline N=1751 Analytic N=1212 Of 1751 women who completed FFQ during pregnancy, 1212 completed follow-up when children were 5y. • Age at recruitment: 29.9y, 95% CI: (29.6, 30.2) • Race/Ethnicity: NR • SES: ○ Partner from non-manual social class: 62.7% ○ Age left full time education: Median=18.5y, IQR=(16.0, 21.0) • Characteristics reported but no test for differences by exposure ○ Smoking ○ Family history ○ BW ○ HMF (Ever)	**Food(s) or Food Group(s):** Apple consumption by tertile • T1: 0-1/wk, n=398 • T2: 1-4/wk, n=427 • T3: >4/wk, n=384 at ~32wk gestation Fish consumption • Never, n=107 • <1/wk, n=255 • ≥1/wk, n=831 at ~32wk gestation Oily fish consumption • Never, n=629 • <1/wk, n=414 • ≥1/wk, n=161 at ~32wk gestation **Dietary assessment methods:** Semi-quantitative, 150-item FFQ, divided into 20 food groups to capture intake over the previous 2-3mo. Responses were categorized as rarely or never, 1-2 times/mo, and separate categories for 1-7 d/wk. Food amounts	**Significant:** Doctor confirmed asthma • Apple Intake, Cases n=145, P for trend=0.008 ○ T1: Ref ○ T2: aOR=0.83, 95% CI: (0.52, 1.32) ○ T3: aOR=0.47, 95% CI: (0.27, 0.82) **Non-significant:** Asthma and wheeze in last 12 mo • Apple Intake, Cases n=145, P for trend=NS There were no consistent linear associations between maternal intake of total fruit, citrus/kiwi fruit, total vegetables, green leafy vegetables, fruit juice, whole grain products, fat from dairy products or butter versus margarine/low fat spread use and respiratory or atopic outcomes in children at 5 y, nor were there consistent associations between maternal intake of food	**Key confounders accounted for:** Age, SES, Smoking (Mother, Household), Family history, BW, HMF **OFCs accounted for:** Child sex **Limitations:** • At least one key confounder not controlled for • Mothers who participated in the study were of higher SES and had slightly higher consumption of fruits, green leafy vegetables, whole grain products and fish. They also had fewer respiratory symptoms. • Multiple exposure outcome comparisons were assessed without using an appropriate p-value correction • No pre-registered data analysis plan **Summary:** Higher maternal apple intake was associated with lower odds of doctor-confirmed asthma in the child at 5y, but not significantly associated with asthma and wheeze in the previous 12mo.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	were recorded as 1 to ≥5 measures per day. The number of measures/d was multiplied by the number of d/wk to obtain the total measures/wk. The food groups of interest in this study were total fruit, citrus/kiwi fruit, apples, total vegetables, green leafy vegetables, pure fruit juice, whole grain products, total fish, total oily fish, total fat from dairy products and exclusive butter versus margarine/low fat spread used as spread. The total number of measures per week was divided into tertiles for total fruit, citrus/kiwi fruit, apples, total vegetables, green leafy vegetables, pure fruit juice, whole grain products and into the categories never, less than once a week, and once or more a week for total fish and total oily fish. To facilitate extrapolation to the general population, subdivisions of food intakes into tertiles were derived from all of the women completing the FFQ and not merely those responding at 5 years. **Outcome:** Asthma **Outcome assessment methods:** Based on ISAAC core questions on symptoms of asthma, including the questions: ‘‘Has your child ever suffered from asthma?’’, ‘‘Has this been confirmed by a doctor?’’ and ‘‘Has your child received treatment for asthma in the past 12 months?’’	groups and spirometry, atopic sensitization, bronchodilator response or exhaled nitric oxide.	

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Willers, 2008[32]; The Netherlands **PCS, PIAMA** Baseline N=3963 Analytic N=2832 • Age at Delivery: 30.3± 3.9y • Race/Ethnicity: NR • SES: ○ Low maternal educational level: 22.6% ○ Low partner's educational level: 24.6% Baseline characteristics NR by exposure	**Food(s) or Food Group(s):** Consumption frequency (rarely, regularly, daily) of following food groups: vegetables, fruit, fish, egg, dairy, nuts, and nut products ~80% completed questionnaire between 30th and 36th wk of gestation **Outcome:** Asthma at 3-8y **Outcome assessment methods:** Self-reported prescription of inhaled corticosteroids for respiratory problems in the last 12mo Self-reported doctor-diagnosed asthma in the last 12mo	**Significant:** Doctor-Diagnosed Asthma From 3-8y: • Nut Product Consumption ○ Daily vs Rarely (Ref): 1.64, 95% CI=(1.03, 2.60), P<0.05 Steroid Use From 3-8y: • Nut Product Consumption ○ Daily vs Rarely (Ref): aOR=1.62, 95% CI=(1.06, 2.46), P<0.05 Steroid Use at 4y: • Nut Product Consumption ○ Daily vs Rarely (Ref): P<0.05 Steroid Use at 6y: • Fruit Consumption ○ Daily vs Regularly + Rarely (Ref): P<0.05 • Nut Product Consumption ○ Daily vs Rarely (Ref): P<0.05 **Non-Significant:** Doctor-Diagnosed Asthma From 3-8y: • Vegetables, Fruit, Dairy Consumption ○ Daily vs Regularly + Rarely (Ref): P=NS • Fish, Egg, Nuts Consumption	**Key confounders accounted for:** SES, Smoking, Family history, BW, HMF practices **OFCs accounted for:** Child Sex **Limitations:** • At least one key confounder not controlled for • Selection into the study was related to exposure and outcome and this could not be adjusted for in analyses • No information on deviation from intended exposures • No pre-registered data analysis plan **Summary:** High maternal nut product intake during pregnancy is associated with a higher risk of childhood asthma at 3-8 years, compared with low intake. Higher maternal fruit product intake during pregnancy is associated with a reduced risk of childhood asthma at 6 y, compared with low intake. Maternal vegetable, dairy, fish, egg, and nut intake during pregnancy was not associated with risk of childhood asthma at 3-8 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
		○ Daily + Regularly vs Rarely (Ref): P=NS • Nut Product Consumption ○ Regularly vs Rarely (Ref): P=NS Steroid Use From 3-8y: • Vegetables, Fruit, Dairy Consumption ○ Daily vs Regularly + Rarely (Ref): P=NS • Fish, Egg, Nuts Consumption ○ Daily + Regularly vs Rarely (Ref): P=NS • Nut Product Consumption ○ Regularly vs Rarely (Ref): P=NS Steroid Use at 3, 4, 5, 7, and 8y: • Fruit Consumption ○ Daily vs Regularly + Rarely (Ref): P=NS Steroid Use at 3, 5, 7, and 8y: • Nut Product Consumption ○ Daily vs Rarely (Ref): P=NS	
Pregnancy and Lactation			
Randomized Controlled Trials			
Fukushima, 1997[8]; Japan **Baseline N=350 Analytic N=283**	**Food(s) or Food Group(s):**	**Significant:** Note, CD had significantly higher odds of overall allergies vs MD at	**Key confounders accounted for:** Smoking, Family history, (CFB for aOR), Pets

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
• Age: NR • Race/Ethnicity: 100% from Japan • SES: NR • Significant differences by exposure (by design): HMF, CFB • No differences by exposure: Smoking, Family history, BW, Pets ~76% had a positive history of allergy (i.e. both parents or one parents or sibling only had history of allergies)	• CD: Mothers instructed to consume >200mL/d cow milk, n=140 randomized, n=127 analyzed • MD: Mothers instructed to consume >200mL/d a casein-free, hypoallergenic formula and to avoid cow milk and reduce consumption of cow milk products, n=140 randomized, n=102 analyzed • AF: Mothers instructed to consume >200mL/d a casein-free, hypoallergenic formula and to avoid cow milk and reduce consumption of cow milk products, n=70 randomized, n=54 analyzed (Not randomized, no relevant comparisons included, except as co-variates in logistic regressions) ○ Also supplemented with 1000 mg/d Ca during late pregnancy through end of lactation up to 6 mo postpartum From birth to 6 mo, the infants in the MD and CD groups were exclusively HMF or mixed-fed with human milk and casein-free, hypoallergenic formula when human milk was insufficient. The infants in the AF group were mixed-fed with human milk and a formula with similar whey:casein ratio as human milk for the corresponding 6mo. Infants who were fed human milk exclusively from birth to 4mo were excluded from the AF group. **Dietary assessment methods:**	12mo, but due to inclusion of asthma these results to not meet NESR criteria **Non-significant:** Asthma prevalence at 24mo, P=NS • CD: aOR=0.79, 95% CI: (0.24, 2.54) • MD: (Ref) Overall allergies at 24mo, P=NS • CD: aOR=1.75, 95% CI: (0.94, 3.25) • MD: (Ref) Note, odds of overall allergies NS at 6 and 18mo. However, due to inclusion of asthma these results do not meet the NESR criteria	**OFCs accounted for:** None **Limitations:** • Randomization process NR • MD still consumed cow milk products, but had lower intake than CD • Attrition higher in MD group because women excluded from analysis if they consumed cow milk • Proportions of missing data seem to differ, reasons for missingness NR • Participants were aware of exposure status and outcomes were self-reported • Eczema logistic regressions only reported at 12 and 24 mo, but data were collected at all 4 time points • Pre-registered data analysis plan NR **Summary:** Consuming diets replacing cow milk with casein-free hypoallergenic formula with reduced consumption of cow milk products from late pregnancy through lactation did not impact overall allergies, including atopic eczema, asthma, and allergic rhinitis.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	Daily food diary from late pregnancy until 6mo postpartum, recording the amount of casein-free, hypoallergenic formula, cow milk, cow milk products, eggs, meat, and soy products consumed. **Outcomes:** Overall allergies (eczema, asthma, and/or allergic rhinitis) at 24mo **Outcome assessment methods:** Self-reported by questionnaire. Specific allergies defined when symptoms chronically lasted for more than a few weeks. Asthma was considered when cough and other respiratory symptoms were observed without any suspicion of infections.		
Zeiger, 1992[36]; U.S. **RCT** Baseline N=379 Analytic N=242 (at 3 y) and 225 (at 4y) • Age: ~28.6y • Race/Ethnicity: ○ Non-White: ~12.5% • SES:	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation • Prophylaxis: Avoided all milk (dairy), egg, and peanut products, concentrated soy foods (i.e., tofu), ≤2 servings/d wheat during 3rd trimester of pregnancy and lactation ○ Prenatal vitamins plus supplemented with a total of 1500 mg/d Ca Both groups encouraged to feed human milk for ≥4-6 mo	**Significant:** **Non-Significant:** The period prevalence of asthma was similar in the prophylactic-treated and control groups at 2, 3, and 4 y.	**Key confounders accounted for:** None **OFCs accounted for:** None **Limitations:** (Note: most of these limitations were identified based on Zeiger 1989 paper) • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
○ Maternal occupation: white collar: ~54.0% ○ Family income <$20,000/y: ~9.7% ○ Maternal Education: ≤High school: ~13.6% • Significant differences by exposure: BW (term, singletons) • No differences by exposure: Smoking, Family history, HMF, CFB, Animal/Pets/Farming exposure Families were included in the study if at least one parent met the following criteria: history of an atopic disorder and specific IgE by skin or RAST testing. Serum was obtained from the participants for total and specific IgE determinations. Participant fathers were skin tested to inhalant antigens at the intake session. Mothers were skin tested to foods and inhalants 4mo postpartum.	**Outcome:** Allergic Rhinitis at 3 y and 4 y Period prevalence: Defined as the proportion of participant currently evidencing a measured parameter Cumulative prevalence: Defined as the proportion of participants evidencing the measured parameter at any past or current time Prophylactic infants used casein hydrolysate (Nutramigen) for supplementation or weaning, and avoided solid foods for 6 mo; cow milk, corn, soy, citrus, and wheat, for 12 mo; and egg, peanut, and fish, for 24 mo. Infants in the control groups Enfamil, a cow milk-based whey infant formula. Solid foods were introduced to control-group infants, based on AAP recommendations.		40:60 (treatment: control) to 50:50 with a new computerized list of random numbers • Rate of drop-out at baseline was significantly different in the prophylaxis vs. control groups (p<0.0001) • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups **Summary:** Maternal avoidance of cow milk, egg, and peanut during the last trimester of pregnancy and lactation, as well as infant avoidance of cow milk until 1 year and egg, peanut, and fish until after 2 y did not result in a lower risk of asthma at 2, 3, and 4 years compared to a control diet.
Zeiger, 1995[34]; U.S. **RCT** Baseline N=379 Analytic N=165	**Food(s) or Food Group(s):** • Control: Mothers encouraged to follow standard diets during 3rd trimester of pregnancy and lactation, n=212 ○ Cow milk-based whey infant formula provided for	**Significant:** **Non-Significant:** Period prevalence, P=NS	**Key confounders accounted for**: None **OFCs accounted for:**

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Power analysis: Yes Of these families, 14 in each group were found to be not atopic, which eliminated them from the study ***See Zeiger, 1992*[36]**	supplementation or weaning through 12mo postpartum. CFB encouraged: no solids <4mo, cereal at 4mo, followed by vegetables, fruits and egg yolks at 6mo, meats at 8mo, and whole cow milk and egg whites at 12mo. • Prophylaxis: Instructed to avoid totally all milk (dairy), egg, and peanut products, avoid concentrated soy foods (i.e., tofu), ≤2 servings/d wheat, with other grains to fulfill cereal and starch requirements during 3rd trimester of pregnancy and lactation, n=167 ○ In addition to prenatal vitamins, the maternal diet was supplemented with a total of 1500 mg/d Ca. ○ A casein hydrolysate infant formula with low sensitization potential provided for supplementation or weaning through 12mo postpartum. CFB encouraged: no solids <6mo, non-legume vegetables, followed by rice cereal at 7mo, meats at 8mo, non-citrus fruits and juices at 9mo, and cow milk at 12mo. Wheat, soy, corn, and citrus introduced thereafter at monthly intervals, followed by egg at 24mo and peanuts and fish at 36mo. • Both groups encouraged to feed human milk for ≥4-6mo **Dietary assessment methods:** Women were randomly assigned to groups. In addition to instructions	Cumulative prevalence, P=NS	None **Limitations:** (Note: most of these limitations were identified based on Zeiger 1989 paper) • More women in the prophylactic-treated group withdrew before delivery because of the protocol's dietary restrictions. As a result, halfway through recruitment, randomization was changed from 40:60 (treatment: control) to 50:50 with a new computerized list of random numbers • Rate of drop-out at baseline was significantly different in the prophylaxis vs. control groups (p<0.0001) • Significantly more non-White fathers in prophylaxis group, and trend to more mothers with low education in control group • 6 pairs of twins omitted from control group after randomization • BW 2.9% lower in term, singletons in prophylactic group (P=0.044); Overall, BW similar between groups • Smoking during postpartum was significantly different between the prophylactic and control groups **Summary:** Maternal avoidance of milk (dairy), egg, and peanut products, avoid concentrated soy foods, and limited intake of wheat during the 3rd trimester of pregnancy through lactation and reduced infant food allergen exposure during CFB did not affect the prevalence of asthma in the child at 7 y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	described above, women in prophylaxis group attended a dietary class was held before the 3rd trimester by a licensed dietitian to provide detailed instructions on the maternal and infant diets, food lists, recipes, and product sources. Adherence to the dietary regimen was ascertained in part by maternal self-report and daily diaries. For both groups: 0.25mg/d Tri-Vi-Flor given to infants according to their pediatrician's preference. Foods causing documented IgE sensitization were removed from the infant's diet until sensitization had waned or were tolerated on double-blind challenge. Parents received intensive education on reducing environmental allergens and tobacco smoke from their homes. **Outcome:** Atopic dermatitis, Allergic rhinitis, Food allergy at 1, 4, 8, and 12 mo **Outcome assessment methods:** Allergic rhinitis was defined as a nasal condition with characteristic symptoms of sneezing, itching, and/or rhinorrhea with concurrent specific IgE and nasal eosinophils (NEs)		
Lactation			
Prospective Cohort Studies			

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
Lumia, 2012[38]; Finland **PCS, DIPP** Baseline N=1798 Analytic N=1798 • Age at Delivery: 30.1± 4.9y • Race/Ethnicity: NR • SES: NR Baseline characteristics NR by exposure	**Food(s) or Food Group(s):** Intake (g/d) categorized into quartiles for following food groups: oils, butter and butter-spreads, industrial fat, fish, meat and meat products, and milk and milk products • Margarine intake (g/d) dichotomized into user/nonuser Assessed once during third month of lactation **Dietary assessment:** Dietary intake during lactation was assessed by a validated, self-administered, semi-quantitative 181-item FFQ. The FFQ was designed to assess the maternal total diet (intake of foods and nutrients) during lactation, over a period of 1 month. The mothers were asked to circle the right picture of the amount of margarine on one slice of bread they used. The consumption frequency was also asked. The use of margarines was classified depending on their fat content: margarines containing 70–80% or 30–60% fat, and brand names were given. **Outcome:** Current asthma at 5y **Outcome assessment methods:** Self-reported doctor-diagnosis plus any wheezing symptom or the use of	**Significant:** Margarines • User vs nonuser: aHR=1.96, 95% CI=(1.01, 3.82), P=0.047 **Non-Significant:** Oils • Q1 and Q4 vs Q2/Q3 combined (Ref): P=NS Butter and butter-spreads • Q1 and Q4 vs Q2/Q3 combined (Ref): P=NS Industrial Fat • Q1 and Q4 vs Q2/Q3 combined (Ref): P=NS Fish • Q1 and Q4 vs Q2/Q3 combined (Ref): P=NS Meat and meat products • Q1 and Q4 vs Q2/Q3 combined (Ref): P=NS Milk and milk products • Q1 and Q4 vs Q2/Q3 combined (Ref): P=NS	**Key Confounders accounted for:** Age, SES, Smoking, Family history, GA, BW, Delivery mode, HMF practices, Animals/pets/farming exposure **OFCs accounted for:** Child Sex **Limitations:** • At least one key confounder not controlled for • Adjusted for post-exposure variable • Outcome may have been subjective and was assessed by participants, who were aware of exposure received • No information on missing outcome data by exposure group • No pre-registered data analysis plan **Summary:** Maternal margarine intake during lactation is associated with a higher risk of childhood asthma at 5y, compared to no intake. Maternal oil, butter and butter-spread, industrial fat, fish, meat and meat product, and milk and milk product intake during lactation are not associated with risk of childhood asthma at 5y.

Study and Participant Characteristics	Intervention/Exposure and Outcomes	Results	Confounding, Study Limitations, and Summary of Findings
	asthma medication during the previous 12mo		

Table 6. Risk of bias for randomized controlled trials examining maternal diet during pregnancy and lactation and risk of child food allergies and atopic allergic diseases[xviii, xix]

	Randomization	Deviations from intended interventions	Missing outcome data	Outcome measurement	Selection of the reported result
Falth-Magnusson, 1987[7]	Low	High	Low	Low	Some concerns
Fukushima, 1997[8]	Some concerns	High	High	High	High
Jirapinyo, 2013[37]	Some concerns	Some concerns	Low	Low	Some concerns
Lilja, 1989[14]	Some concerns	Some concerns	Low	Low	High
Lovegrove, 1994[16]	Some concerns	High	Some concerns	Low	Some concerns

Table 7. Risk of bias for non-randomized controlled trials examining maternal diet during pregnancy and lactation and risk of child food allergies and atopic allergic diseases[xx]

	Confounding	Selection of participants	Classification of exposures	Deviations from intended exposures	Missing data	Outcome measurement	Selection of the reported result
Herrmann, 1996[10]	Serious	Serious	Moderate	Serious	Moderate	Serious	Serious

[xviii] A detailed description of the methodology used for assessing risk of bias is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews and in Part C of the following reference: Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

[xix] Possible ratings of low, some concerns, or high determined using the "Cochrane Risk-of-bias 2.0" (RoB 2.0) (August 2016 version)" (Higgins JPT, Sterne JAC, Savović J, Page MJ, Hróbjartsson A, Boutron I, Reeves B, Eldridge S. A revised tool for assessing risk of bias in randomized trials In: Chandler J, McKenzie J, Boutron I, Welch V (editors). Cochrane Methods. *Cochrane Database of Systematic Reviews* 2016, Issue 10 (Suppl 1). dx.doi.org/10.1002/14651858.CD201601.)

[xx] Possible ratings of low, moderate, serious, critical, or no information determined using the "Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool" (Sterne JAC, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, Henry D, Altman DG, Ansari MT, Boutron I, Carpenter JR, Chan AW, Churchill R, Deeks JJ, Hróbjartsson A, Kirkham J, Jüni P, Loke YK, Pigott TD, Ramsay CR, Regidor D, Rothstein HR, Sandhu L, Santaguida PL, Schünemann HJ, Shea B, Shrier I, Tugwell P, Turner L, Valentine JC, Waddington H, Waters E, Wells GA, Whiting PF, Higgins JPT. ROBINS-I: a tool for assessing risk of bias in non-randomized studies of interventions. BMJ 2016; 355; i4919; doi: 10.1136/bmj.i4919.)

Table 8. Risk of bias for observational studies examining maternal diet during pregnancy and lactation and risk of child food allergies and atopic allergic diseases[xxi]

	Confounding	Selection of participants	Classification of exposures	Deviations from intended exposures	Missing data	Outcome measurement	Selection of the reported result
Bédard, 2018[2]	Serious	Moderate	Moderate	Serious	Low	Moderate	Serious
Bédard, 2020[1]	Serious	Moderate	Moderate	No information	Low	Serious	Serious
Bertelsen, 2014[3]	Serious	Moderate	Moderate	Moderate	Serious	Serious	Serious
Bunyavanich, 2014[4]	Serious	Moderate	Moderate	No information	Serious	Moderate	Serious
Chatzi, 2013[5]	Serious	Serious	Serious	No information	No information	Serious	Serious
Chen, 2020[6]	Serious	Moderate	Moderate	Moderate	Serious	Moderate	Serious
Hanson, 2020[9]	Serious	Moderate	Moderate	Moderate	Low	Moderate	Serious
Leermakers, 2013[13]	Serious	Moderate	Moderate	Moderate	Moderate	Moderate	Serious
Jedrychowski, 2011[11]	Serious	Serious	Serious	Serious	No information	Serious	Serious
Lack, 2003[12]	Critical	Serious	Serious	No information	No information	Low	Critical
Loo, 2017[15]	Serious	Moderate	Moderate	No information	Moderate	Moderate	Serious
Lumia, 2012[38]	Serious	Moderate	Serious	Moderate	No information	Moderate	Serious
Maslova, 2012[17]	Serious	Serious	Moderate	Serious	Moderate	Moderate	Critical
Maslova, 2012[18]	Serious	Serious	Moderate	Serious	Moderate	Moderate	Critical
Maslova, 2013[19]	Serious	Serious	Moderate	No information	No information	Serious	Serious
Maslova, 2013[20]	Serious	Serious	Moderate	Serious	Moderate	Moderate	Serious
Miyake, 2009[24]	Serious	Moderate	Moderate	No information	No information	Serious	Serious
Miyake, 2010[23]	Serious	Moderate	Moderate	No information	No information	Serious	Serious
Miyake, 2010[22]	Serious	Moderate	Moderate	No information	No information	Serious	Serious
Miyake, 2011[21]	Serious	Moderate	Moderate	No information	No information	Serious	Serious
Miyake, 2013[25]	Serious	Moderate	Moderate	No information	No information	Serious	Serious
Miyake, 2014[26]	Serious	Moderate	Moderate	No information	No information	Serious	Serious
Nguyen, 2017[27]	Serious	Moderate	Moderate	Moderate	No information	Moderate	Serious

[xxi] Possible ratings of low, moderate, serious, critical, or no information determined using the "Risk of Bias for Nutrition Observational Studies" tool (RoB-NObs) (Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.)

Saito, 2010[28]	**Serious**	**Moderate**	**Moderate**	**No information**	**No information**	**Serious**	**Serious**
Shaheen, 2009[29]	**Serious**	**Moderate**	**Moderate**	**Moderate**	**Serious**	**Serious**	**Serious**
Viljoen, 2018[30]	**Serious**	**Serious**	**Moderate**	**Moderate**	**Serious**	**Moderate**	**Critical**
Willers, 2007[31]	**Serious**	**Moderate**	**Moderate**	**Moderate**	**Serious**	**Moderate**	**Serious**
Willers, 2008[32]	**Serious**	**Serious**	**Moderate**	**No information**	**Serious**	**Moderate**	**Serious**
Wright, 2018[33]	**Serious**	**Moderate**	**Moderate**	**Moderate**	**Serious**	**Moderate**	**Serious**

METHODOLOGY

The NESR team used its rigorous, protocol-driven methodology to support the 2020 Dietary Guidelines Advisory Committee in conducting this systematic review.
NESR's systematic review methodology involves:

- Developing a protocol,
- Searching for and selecting studies,
- Extracting data from and assessing the risk of bias of each included study,
- Synthesizing the evidence,
- Developing conclusion statements,
- Grading the evidence underlying the conclusion statements, and
- Recommending future research.

A detailed description of the methodology used in conducting this systematic review is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews, and can be found in the 2020 Dietary Guidelines Advisory Committee Report, Part C: Methodology.[xxii] This systematic review was peer reviewed by Federal scientists, and information about the peer review process can also be found in the Committee's Report, Part C. Methodology. Additional information about this systematic review, including a description of and rationale for any modifications made to the protocol can be found in the 2020 Dietary Guidelines Advisory Committee Report, Chapter 2. Food, Beverage, and Nutrient Consumption During Pregnancy and Chapter 3. Food, Beverage, and Nutrient Consumption During Lactation.

Below are details of the final protocol for the systematic review described herein, including the:

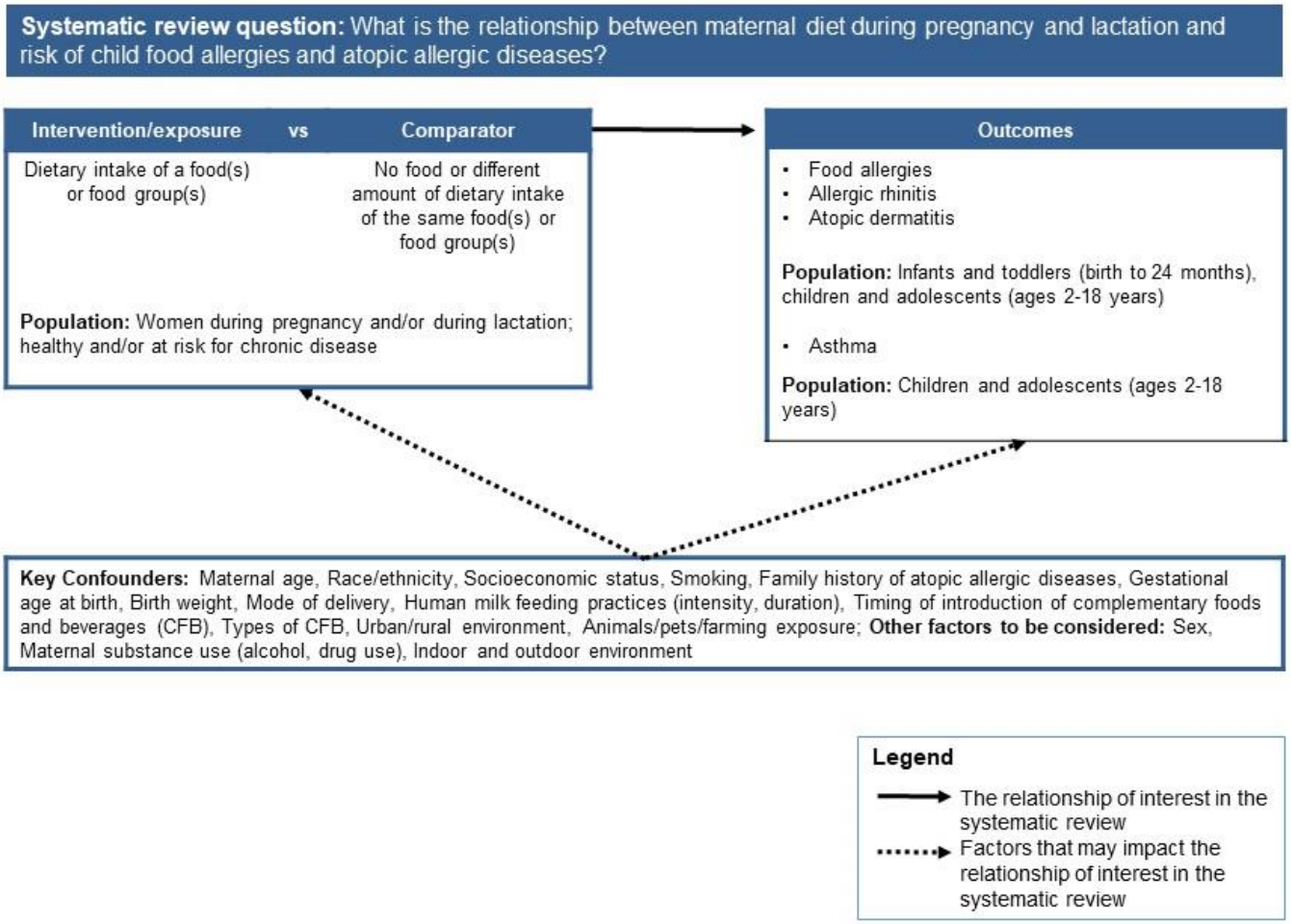
- Analytic framework
- Literature search and screening plan
- Literature search and screening results

ANALYTIC FRAMEWORK

The analytic framework (Figure 1: Analytic framework**Figure 1**) illustrates the overall scope of the systematic review, including the population, the interventions and/or exposures, comparators, and outcomes of interest. It also includes definitions of key terms and identifies key confounders considered in the systematic review. The inclusion and exclusion criteria that follow provide additional information about how parts of the analytic framework were defined and operationalized for the review.

[xxii] Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

Figure 1: Analytic framework



LITERATURE SEARCH AND SCREENING PLAN

Inclusion and exclusion criteria

This table provides the inclusion and exclusion criteria for the systematic review. The inclusion and exclusion criteria are a set of characteristics used to determine which articles identified in the literature search were included in or excluded from the systematic review.

Table 9. Inclusion and exclusion criteria

Category	Inclusion Criteria	Exclusion Criteria
Study design	• Randomized controlled trials • Non-randomized controlled trials including quasi-experimental and controlled before-and-after studies • Prospective cohort studies • Retrospective cohort studies • Nested case-control studies	• Uncontrolled trials • Case-control studies • Cross-sectional studies • Uncontrolled before-and-after studies • Narrative reviews • Systematic reviews • Meta-analyses
Intervention/ exposure	• Dietary intake of a food(s) or food group(s)	
Comparator	• Different amount of dietary intake of the same food(s) or food group(s)	• No comparator
Outcomes	• Food allergies • Atopic dermatitis • Allergic rhinitis • Asthma (≥2 years old)	• Food allergy when diagnosis was based solely on food allergen sensitization (i.e., skin prick test, or serum IgE measure) (i.e., without an oral food challenge or parental report of clinical history) • Asthma when diagnosis was based solely on report of wheeze
Date of publication	• January 1980 to January 2020	• Articles published before January 1980 or after January 2020

Category	Inclusion Criteria	Exclusion Criteria
Publication status	• Articles that have been peer-reviewed	• Articles that have not been peer-reviewed and are not published in peer-reviewed journals, including unpublished data, manuscripts, reports, abstracts, and conference proceedings
Language of publication	• Articles published in English	• Articles published in languages other than English
Country[xxiii]	• Studies conducted in countries ranked as high or very high human development	• Studies conducted in countries ranked as medium or lower human development
Study participants	• Human participants	• Non-human participants (e.g., animal or in-vitro models)
Life stage of study participants - *intervention or exposure*	• Women during pregnancy OR women during both pregnancy and lactation, regardless of human milk feeding status • Women during lactation who are exclusively or predominantly feeding human milk	• Studies conducted ***exclusively*** in non-lactating women or in lactating women who are not exclusively or predominantly feeding human milk.
Life stage of study participants - *outcomes*:	Food allergies, atopic dermatitis, and allergic rhinitis: • Infants and toddlers (birth – 24 months) All outcomes: • Children and adolescents (2 – 18 years)	Asthma: • Infants and toddlers (birth – 24 months) All outcomes: • Adults (19 – 64 years) • Older adults (65 years and older)

[xxiii] The Human Development classification was based on the Human Development Index (HDI) ranking from the year the study intervention occurred or data were collected (UN Development Program. HDI 1990-2017 HDRO calculations based on data from UNDESA (2017a), UNESCO Institute for Statistics (2018), United Nations Statistics Division (2018b), World Bank (2018b), Barro and Lee (2016) and IMF (2018). Available from: http://hdr.undp.org/en/data). If the study did not report the year in which the intervention occurred or data were collected, the HDI classification for the year of publication was applied. HDI values are available from 1980, and then from 1990 to present. If a study was conducted prior to 1990, the HDI classification from 1990 was applied. When a country was not included in the HDI ranking, the current country classification from the World Bank was used instead (The World Bank. World Bank country and lending groups. Available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world- country-and-lending-groups).

Category	Inclusion Criteria	Exclusion Criteria

Health status of study participants	• Studies that enroll participants who are healthy and/or at risk for chronic disease, including those with obesity
	• Studies that enroll ***some*** children diagnosed with a disease or with the health outcome of interest:
	  ○ Food allergies
	  ○ Atopic dermatitis
	  ○ Allergic rhinitis
	  ○ Asthma
		• Studies that ***exclusively*** enroll mothers who gave birth to preterm (<37 weeks and 0/7 days) infants
		• Studies that ***exclusively*** enroll mothers diagnosed with a chronic disease, including severe undernutrition or hospitalized with an illness or injury

Electronic databases and search terms

PubMed

- Provider: U.S. National Library of Medicine
- Date searched: January 21, 2020
- Date range searched: January 1, 1980 – January 21, 2020
- Search terms:

#1 - Diet [Mesh] OR diet[tiab] OR diets[tiab] OR dietary[tiab] OR food*[tiab] OR foods[tiab] OR "Food"[Mesh] OR "Eating"[Mesh] OR (maternal tiab] AND intake[tiab])

#2 - (("Allergy and Immunology"[Mesh:NoExp] OR allerg*[tiab] OR Hypersensitiv*[tiab] OR atopic[tiab]) AND (food*[tiab] OR peanut*[tiab] OR nut[tiab] OR nuts[tiab] OR egg*[tiab] OR eggs[tiab] OR milk[tiab] OR shellfish[tiab] OR fish[tiab] OR fishes[Mesh] OR seafood[Mesh] OR wheat[tiab] OR gluten*[tiab] OR glutens[Mesh] OR dairy[tiab] OR dairy products[Mesh] OR eggs[Mesh] OR nuts[Mesh] OR soy foods[mh] OR soy*[tiab])) OR "Food Hypersensitivity"[Mesh] OR asthma*[tiab] OR asthma[Mesh] OR "Rhinitis, Allergic"[Mesh] OR (allerg*[tiab] AND rhiniti*[tiab]) OR "Dermatitis, Atopic"[Mesh] OR atopic dermatitis*[tiab] OR eczema*[tiab] OR eczema[Mesh] OR "Immunoglobulin E"[Mesh] OR "Immunoglobulin E"[tiab] OR IgE[tiab]

#3 - ("Pregnancy"[Mesh] OR “Pregnancy Complications”[Mesh] OR “Maternal Exposure”[Mesh] OR “pregnant women”[Mesh] OR pregnan*[tiab] OR pre-pregnancy[tiab] OR prenatal[tiab] OR pre-natal[tiab] OR maternal[tiab] OR mother*[tiab] OR “Mothers”[Mesh] OR perinatal[tiab] OR peri-natal[tiab] OR pre-conception[tiab] OR preconception[tiab] OR peri-conception[tiab] OR periconception[tiab] OR "Peripartum Period"[Mesh] OR peripartum[tiab] OR peri-partum[tiab] OR gestat*[tiab] OR natal[tiab] OR antenatal[tiab] OR ante-natal[tiab] OR puerperium[tiab] OR "Maternal Nutritional Physiological Phenomena"[Mesh] OR "Postpartum Period"[Mesh] OR postpart*[tiab] OR post-part*[tiab] OR pre-parturition[tiab] OR postnatal[tiab] OR post-natal[tiab] OR post delivery[tiab] OR postdelivery[tiab] OR after birth[tiab] OR afterbirth[tiab] OR Lactation[Mesh] OR lactati*[tiab] OR breast feeding[Mesh] OR breastfe*[tiab] OR breast fe*[tiab] OR Milk, Human [Mesh] OR breastmilk[tiab] OR "breast

milk"[tiab] OR "human milk"[tiab] OR "maternal milk"[tiab] OR "nursing women"[tiab]))

#4 - #1 AND #2 AND #3

#5 - #4 NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh])) NOT (editorial[ptyp] OR comment[ptyp] OR news[ptyp] OR letter[ptyp] OR review[ptyp] OR systematic review[ptyp] OR systematic review[ti] OR meta-analysis[ptyp] OR meta-analysis[ti] OR meta-analyses[ti] OR retracted publication[ptyp] OR retraction of publication[ptyp] OR retraction of publication[tiab] OR retraction notice[ti])

Filters: Publication date from 1980/01/01 to 2020/01/21; English

Cochrane Central Register of Controlled Trials (CENTRAL)

- Provider: John Wiley & Sons
- Date searched: January 21, 2020
- Date range searched: January 1, 1980 – January 21, 2020
- Search terms:

#1 - [mh "Diet"] OR diet OR diets OR dietary OR food* OR foods OR [mh "Food"] OR [mh "Eating"] OR (maternal NEAR/4 intake)

#2 - [mh ^"Allergy and Immunology"] OR ((allerg* OR Hypersensitivit*) NEAR/4 (food* OR peanut* OR nut OR nuts OR egg* OR milk OR shellfish OR seafood* OR wheat OR gluten* OR dairy OR fish OR soy*)) OR [mh "Food Hypersensitivity"] OR asthma* OR [mh "Rhinitis, Allergic"] OR (allerg* NEAR/4 Rhiniti*) OR [mh "Dermatitis, Atopic"] OR ((Dermatiti* OR eczema) NEAR/4 Atopic) OR (Infant* NEAR/4 Eczema) OR [mh "Immunoglobulin E"] OR "Immunoglobulin E"

#3 - [mh "Pregnancy"] OR [mh "Pregnancy Complications"] OR [mh "Prenatal Exposure Delayed Effects"] OR [mh "Maternal Exposure"] OR [mh "Pregnant Women"] OR [mh "Mothers"] OR [mh "Peripartum Period"] OR [mh "Maternal Nutritional Physiological Phenomena"] OR [mh "Postpartum Period"] OR [mh Lactation] OR [mh "Breast Feeding"] OR [mh "Milk, Human"] OR (pregnancy OR pre-pregnancy OR prenatal OR pre-natal OR maternal OR mother* OR postpartum OR perinatal OR peri-natal OR pre-conception OR preconception OR peri-conception OR periconception OR peripartum OR peri-partum OR gestat* OR natal OR antenatal OR ante-natal OR puerperium OR postpartum OR post-partum OR perinatal OR peri-natal OR puerperium OR postpartal OR post-partal OR postnatal OR “post delivery” OR “after birth” OR lactation OR lactating OR breastfeeding OR breast-feeding OR breast feed* OR breast-feed* OR breastfed OR breast-fed OR breastfeed OR “human milk” OR “nursing women”):ti,ab,kw

#4 - #1 AND #2 AND #3

Filters: Publication Year from 1980 to 2020, in Trials

Embase

- Provider: Elsevier
- Date searched: January 21, 2020
- Date range searched: January 1, 1980 – January 21, 2020
- Search terms:

#1 - 'diet'/exp OR 'food'/exp OR 'eating'/exp OR diet:ti,ab OR diets:ti,ab OR dietary:ti,ab OR food:ti,ab OR foods:ti,ab OR (maternal NEAR/4 intake*) OR eating:ti,ab OR eat:ti,ab

#2 - 'allergic asthma'/exp OR 'food allergy'/exp OR 'allergic rhinitis'/exp OR 'dermatitis'/exp OR 'eczema'/exp OR 'skin allergy'/exp OR ((allerg* OR hypersensitivity*) NEAR/4 (food OR peanut* OR nut OR nuts OR egg OR eggs OR milk OR shellfish OR seafood* OR wheat OR gluten* OR fish OR dairy OR soy*)) OR 'immunoglobulin e'/exp OR 'immunoglobulin e':ti,ab

#3 - pregnancy:ab,ti OR 'pre pregnancy':ab,ti OR prenatal:ab,ti OR 'pre natal':ab,ti OR maternal:ab,ti OR mother:ab,ti OR mothers:ab,ti OR 'pre conception':ab,ti OR preconception:ab,ti OR 'peri conception':ab,ti OR periconception:ab,ti OR peripartum:ab,ti OR 'peri partum':ab,ti OR gestation*:ab,ti OR natal:ab,ti OR antenatal:ab,ti OR 'ante natal':ab,ti OR postpartum:ab,ti OR post-partum:ab,ti OR perinatal:ab,ti OR 'peri natal':ab,ti OR puerperium:ab,ti OR postpartal:ab,ti OR post-partal:ab,ti OR postnatal:ab,ti OR 'post delivery':ab,ti OR 'after birth':ab,ti OR lactation:ab,ti OR lactating:ab,ti OR breastfeeding:ab,ti OR breast-feeding:ab,ti OR 'breast feed*':ab,ti OR breastfed:ab,ti OR 'breast fed':ab,ti OR breastfeed:ab,ti OR 'human milk':ab,ti OR 'nursing women':ab,ti OR 'pregnancy'/exp/mj OR 'pregnancy complication'/exp/mj OR 'prenatal exposure'/mj OR 'maternal exposure'/mj OR 'pregnant woman'/mj OR 'mother'/mj OR 'puerperium'/exp/mj OR 'maternal nutrition'/mj OR 'lactation'/mj OR 'breast feeding'/exp/mj OR 'breast milk'/exp/mj

#4 - #1 AND #2 AND #3

#5 - #4 AND ([article]/lim OR [article in press]/lim) AND [humans]/lim AND [english]/lim AND [1980-2020]/py NOT ([conference abstract]/lim OR [conference paper]/lim OR [editorial]/lim OR [erratum]/lim OR [letter]/lim OR [note]/lim OR [review]/lim OR [systematic review]/lim OR [meta analysis]/lim)

Cumulative Index of Nursing and Allied Health Literature (CINAHL Plus)

- Provider: EBSCOhost
- Date searched: January 21, 2020
- Date range searched: January 1, 1980 – January 21, 2020
- Search terms:

#1 - (mh "Diet") OR diet OR diets OR dietary OR food OR foods[tiab] OR (mh "Food") OR (mh "Eating") OR (maternal N4 intake*)

#2 - (mh "Allergy and Immunology") OR ((allerg* OR Hypersensitivit*) N4 (food* OR peanut* OR nut OR nuts OR egg* OR milk OR shellfish OR seafood OR wheat OR gluten* OR dairy OR fish OR soy*)) OR (mh "Food Hypersensitivity+") OR asthma* OR (mh "Rhinitis, Allergic") OR (allerg* N4 Rhiniti*) OR (mh "Dermatitis, Atopic") OR ((Dermatiti* OR eczema) N4 Atopic)) OR (Infant* N5 Eczema) OR (mh "Immunoglobulin E") OR "Immunoglobulin E"

#3 - postpartum OR post-partum OR MH "Postpartum Period" OR postpartal OR post-partal OR postnatal OR post-natal OR "post deliver*" OR "after birth" OR MH pregnancy OR MH “pregnancy complications” OR MH "Prenatal Exposure Delayed Effects" OR MH "Maternal Exposure" OR MH "pregnant women" OR pregnan* OR pre-pregnancy OR prepregnancy OR prenatal OR antenatal OR maternal OR mother OR mothers OR perinatal OR peri-natal OR peri-conception OR periconception OR MH "Peripartum Period" OR peripartum OR peri-partum OR gestation* OR natal OR puerperium OR MH "Maternal Nutritional Physiological Phenomena" OR MH "Breast Feeding"OR breastfeeding OR breast-feeding OR MH "Milk, Human" OR “human milk” OR MH Lactation OR lactation OR lactating OR breastfeeding OR “breast feed*” OR breast-feed* OR breastfed OR breast-fed OR breastfeed* OR "nursing women" OR “nursing mother*”

#4 - #1 AND #2 AND #3

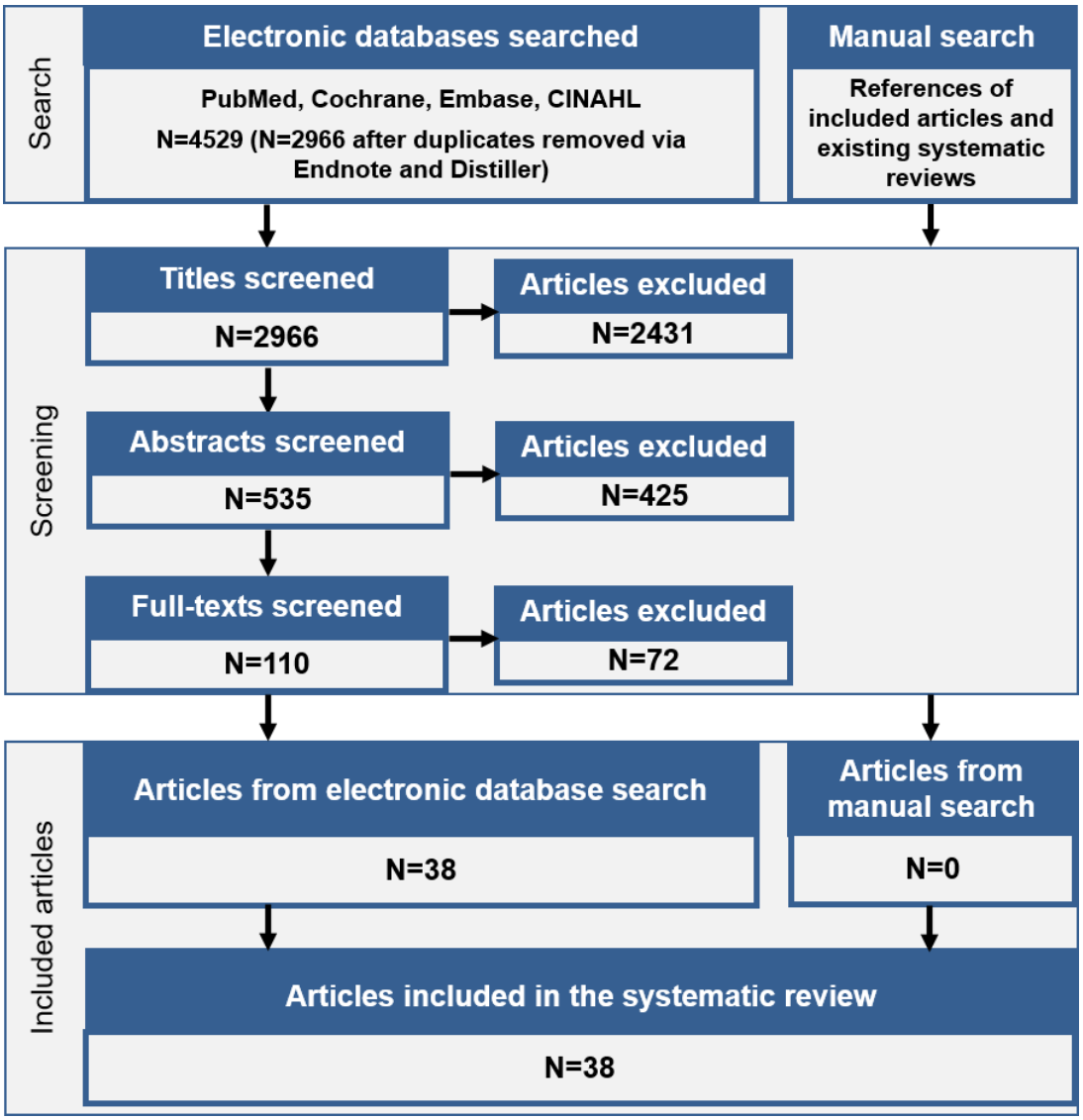
#5 - #4 NOT (MH "Literature Review" OR MH "Meta Analysis" OR MH "Systematic Review" OR MH "News" OR MH "Retracted Publication" OR MH "Retraction of Publication)

Filters: Published Date: 19800101 – 20200121, English Language, Human

LITERATURE SEARCH AND SCREENING RESULTS

The flow chart (**Figure 2**) below illustrates the literature search and screening results for articles examining the systematic review question. The results of the electronic database searches, after removal of duplicates, were screened independently by two NESR analysts using a step-wise process by reviewing titles, abstracts, and full-texts to determine which articles met the inclusion criteria. Refer to **Table 10** for the rationale for exclusion for each excluded full-text article. A manual search was done to find articles that were not identified when searching the electronic databases; all manually identified articles are also screened to determine whether they meet criteria for inclusion.

Figure 2: Flow chart of literature search and screening results



Excluded articles

The table below lists the articles excluded after full-text screening, and includes columns for the categories of inclusion and exclusion criteria (see **Table 9**) that studies were excluded based on. At least one reason for exclusion is provided for each article, though this may not reflect all possible reasons for exclusion. Information about articles excluded after title and abstract screening is available upon request.

Table 10. Articles excluded after full text screening with rationale for exclusion

	Citation	Rationale
1.	Abrams, EM, Sicherer, SH. Maternal peanut consumption and risk of peanut allergy in childhood. Cmaj. 2018. 190:E814-e815. doi:10.1503/cmaj.180563.	Study design
2.	Alvarez Zallo, N, Aguinaga-Ontoso, I, Alvarez-Alvarez, I, Marin-Fernandez, B, Guillen-Grima, F, Azcona-San Julian, C. Influence of the Mediterranean diet during pregnancy in the development of wheezing and eczema in infants in Pamplona, Spain. Allergol Immunopathol (Madr). 2018. 46:9-14. doi:10.1016/j.aller.2017.02.009.	Study design; Outcome
3.	Arshad, SH, Bateman, B, Sadeghnejad, A, Gant, C, Matthews, SM. Prevention of allergic disease during childhood by allergen avoidance: the Isle of Wight prevention study. J Allergy Clin Immunol. 2007. 119:307-13. doi:10.1016/j.jaci.2006.12.621.	Population; Not 100% human milk feeding
4.	Baiz, N, Just, J, Chastang, J, Forhan, A, de Lauzon-Guillain, B, Magnier, AM, Annesi-Maesano, I. Maternal diet before and during pregnancy and risk of asthma and allergic rhinitis in children. Allergy Asthma Clin Immunol. 2019. 15:40. doi:10.1186/s13223-019-0353-2.	Exposure assessed after delivery
5.	Bedard, A, Northstone, K, Henderson, AJ, Shaheen, SO. Maternal intake of sugar during pregnancy and childhood respiratory and atopic outcomes. Eur Respir J. 2017. 50. doi:10.1183/13993003.00073-2017.	Intervention/Exposure
6.	Berdi, M, de Lauzon-Guillain, B, Forhan, A, Castelli, FA, Fenaille, F, Charles, MA, Heude, B, Junot, C, Adel-Patient, K. Immune components of early breastmilk: Association with maternal factors and with reported food allergy in childhood. Pediatr Allergy Immunol. 2019. 30:107-116. doi:10.1111/pai.12998.	Outcome
7.	Binkley, KE, Leaver, C, Ray, JG. Antenatal risk factors for peanut allergy in children. Allergy Asthma Clin Immunol. 2011. 7:17. doi:10.1186/1710-1492-7-17.	Study design
8.	Bisgaard, H, Stokholm, J, Chawes, BL, Vissing, NH, Bjarnadottir, E, Schoos, AM, Wolsk, HM, Pedersen, TM, Vinding, RK, Thorsteinsdottir, S, Folsgaard, NV, Fink, NR, Thorsen, J, Pedersen, AG, Waage, J, Rasmussen, MA, Stark, KD, Olsen, SF, Bonnelykke, K. Fish Oil-Derived Fatty Acids in Pregnancy and Wheeze and Asthma in Offspring. N Engl J Med. 2016. 375:2530-9. doi:10.1056/NEJMoa1503734.	Intervention/Exposure

	Citation	Rationale
9.	Calvani, M, Alessandri, C, Sopo, SM, Panetta, V, Pingitore, G, Tripodi, S, Zappala, D, Zicari, AM. Consumption of fish, butter and margarine during pregnancy and development of allergic sensitizations in the offspring: role of maternal atopy. Pediatr Allergy Immunol. 2006. 17:94-102. doi:10.1111/j.1399-3038.2005.00367.x.	Study design
10.	Castro-Rodriguez, JA, Garcia-Marcos, L, Sanchez-Solis, M, Perez-Fernandez, V, Martinez-Torres, A, Mallol, J. Olive oil during pregnancy is associated with reduced wheezing during the first year of life of the offspring. Pediatr Pulmonol. 2010. 45:395-402. doi:10.1002/ppul.21205.	Study design; Population
11.	Castro-Rodriguez, JA, Ramirez-Hernandez, M, Padilla, O, Pacheco-Gonzalez, RM, Perez-Fernandez, V, Garcia-Marcos, L. Effect of foods and Mediterranean diet during pregnancy and first years of life on wheezing, rhinitis and dermatitis in preschoolers. Allergol Immunopathol (Madr). 2016. 44:400-9. doi:10.1016/j.aller.2015.12.002.	Study design; Intervention/Exposure
12.	Celik, V, Beken, B, Yazicioglu, M, Ozdemir, PG, Sut, N. Do traditional fermented foods protect against infantile atopic dermatitis. Pediatr Allergy Immunol. 2019. 30:540-546. doi:10.1111/pai.13045.	Study design
13.	Chandra, RK, Puri, S, Suraiya, C, Cheema, PS. Influence of maternal food antigen avoidance during pregnancy and lactation on incidence of atopic eczema in infants. Clin Allergy. 1986. 16:563-9. doi:10.1111/j.1365-2222.1986.tb01995.x.	Retracted
14.	Chapman, DJ. Does maternal diet contribute to colic among breastfed infants?. J Hum Lact. 2006. 22:236-7. doi:10.1177/0890334406287108.	Study design; Outcome
15.	Chatzi, L, Torrent, M, Romieu, I, Garcia-Esteban, R, Ferrer, C, Vioque, J, Kogevinas, M, Sunyer, J. Mediterranean diet in pregnancy is protective for wheeze and atopy in childhood. Thorax. 2008. 63:507-13. doi:10.1136/thx.2007.081745.	Outcome
16.	Dean, T, Venter, C, Pereira, B, Grundy, J, Clayton, CB, Higgins, B. Government advice on peanut avoidance during pregnancy--is it followed correctly and what is the impact on sensitization?. J Hum Nutr Diet. 2007. 20:95-9. doi:10.1111/j.1365-277X.2007.00751.x.	Intervention/Exposure; Outcome
17.	Dotterud, CK, Storro, O, Simpson, MR, Johnsen, R, Oien, T. The impact of pre- and postnatal exposures on allergy related diseases in childhood: a controlled multicentre intervention study in primary health care. BMC Public Health. 2013. 13:123. doi:10.1186/1471-2458-13-123.	Study design; Comparator; Cross-sectional data for control cohort
18.	Dubakiene, R, Rudzeviciene, O, Butiene, I, Sezaite, I, Petronyte, M, Vaicekauskaite, D, Zvirbliene, A. Studies on early allergic sensitization in the Lithuanian birth cohort. ScientificWorldJournal. 2012. 2012:909524. doi:10.1100/2012/909524.	Exposure-outcome analysis not clear, data not reported

	Citation	Rationale
19.	Erkkola, M, Nwaru, BI, Kaila, M, Kronberg-Kippila, C, Ilonen, J, Simell, O, Veijola, R, Knip, M, Virtanen, SM. Risk of asthma and allergic outcomes in the offspring in relation to maternal food consumption during pregnancy: a Finnish birth cohort study. Pediatr Allergy Immunol. 2012. 23:186-94. doi:10.1111/j.1399-3038.2012.01272.x.	Study design; Diet assessed after birth
20.	Erratum: effect of combined maternal and infant food-allergen avoidance on development of atopy in early infancy: a randomized study (Zeiger et al (1989) 84 (72)). Journal of allergy and clinical immunology. 1989. 84:677-.	Erratum
21.	Falth-Magnusson, K, Kjellman, NI. Allergy prevention by maternal elimination diet during late pregnancy--a 5-year follow-up of a randomized study. J Allergy Clin Immunol. 1992. 89:709-13. doi:10.1016/0091-6749(92)90378-f.	Outcome
22.	Falth-Magnusson, K. Breast milk antibodies to foods in relation to maternal diet, maternal atopy and the development of atopic disease in the baby. Int Arch Allergy Appl Immunol. 1989. 90:297-300. doi:10.1159/000235041.	Outcome
23.	Fitzsimon, N, Fallon, U, O'Mahony, D, Loftus, BG, Bury, G, Murphy, AW, Kelleher, CC. Mothers' dietary patterns during pregnancy and risk of asthma symptoms in children at 3 years. Ir Med J. 2007. 100:suppl 27-32.	Study design; Population
24.	Frazier, AL, Camargo, CA, Jr, Malspeis, S, Willett, WC, Young, MC. Prospective study of peripregnancy consumption of peanuts or tree nuts by mothers and the risk of peanut or tree nut allergy in their offspring. JAMA Pediatr. 2014. 168:156-62. doi:10.1001/jamapediatrics.2013.4139.	Population
25.	Fukuda, Y, Yamamoto, S, Kameda, M. Association Between Lifestyle Characteristics and Body Mass Index of Mothers of Children With Allergic Diseases. J Clin Med Res. 2019. 11:780-788. doi:10.14740/jocmr3976.	Study design; Health Status
26.	Gao, X, Yan, Y, Zeng, G, Sha, T, Liu, S, He, Q, Chen, C, Li, L, Xiang, S, Li, H, Tan, S, Yan, Q. Influence of prenatal and early-life exposures on food allergy and eczema in infancy: a birth cohort study. BMC Pediatr. 2019. 19:239. doi:10.1186/s12887-019-1623-3.	Study design; Diet assessed after birth
27.	Hansen, S, Strom, M, Maslova, E, Dahl, R, Hoffmann, HJ, Rytter, D, Bech, BH, Henriksen, TB, Granstrom, C, Halldorsson, TI, Chavarro, JE, Linneberg, A, Olsen, SF. Fish oil supplementation during pregnancy and allergic respiratory disease in the adult offspring. J Allergy Clin Immunol. 2017. 139:104-111.e4. doi:10.1016/j.jaci.2016.02.042.	Intervention/Exposure;
28.	Harris, JM, Cullinan, P, Williams, HC, Mills, P, Moffat, S, White, C, Newman Taylor, AJ. Environmental associations with eczema in early life. Br J Dermatol. 2001. 144:795-802. doi:10.1046/j.1365-2133.2001.04135.x.	Intervention/Exposure; Population
29.	Hattevig, G, Kjellman, B, Sigurs, N, Bjorksten, B, Kjellman, NI. Effect of maternal avoidance of eggs, cow's milk and fish during lactation upon allergic manifestations in infants. Clin Exp Allergy. 1989. 19:27-32. doi:10.1111/j.1365-2222.1989.tb02339.x.	Population; Human milk feeding practices unclear

	Citation	Rationale
30.	Hattevig, G, Kjellman, B, Sigurs, N, Grodzinsky, E, Hed, J, Bjorksten, B. The effect of maternal avoidance of eggs, cow's milk, and fish during lactation on the development of IgE, IgG, and IgA antibodies in infants. J Allergy Clin Immunol. 1990. 85:108-15. doi:10.1016/0091-6749(90)90231-r.	Outcome
31.	Hattevig, G, Sigurs, N, Kjellman, B. Effects of maternal dietary avoidance during lactation on allergy in children at 10 years of age. Acta Paediatr. 1999. 88:7-12.	Population; Human milk feeding practices unclear
32.	Hoppu, U, Kalliomaki, M, Isolauri, E. Maternal diet rich in saturated fat during breastfeeding is associated with atopic sensitization of the infant. Eur J Clin Nutr. 2000. 54:702-5. doi:10.1038/sj.ejcn.1601079.	Intervention/Exposure;
33.	Jonsson, K, Barman, M, Moberg, S, Sjoberg, A, Brekke, HK, Hesselmar, B, Johansen, S, Wold, AE, Sandberg, AS. Fat intake and breast milk fatty acid composition in farming and nonfarming women and allergy development in the offspring. Pediatr Res. 2016. 79:114-23. doi:10.1038/pr.2015.187.	Outcome; Composite outcome
34.	Jonsson, K, Barman, M, Moberg, S, Sjoberg, A, Brekke, HK, Hesselmar, B, Sandberg, AS, Wold, AE. Serum fatty acids in infants, reflecting family fish consumption, were inversely associated with allergy development but not related to farm residence. Acta Paediatr. 2016. 105:1462-1471. doi:10.1111/apa.13592.	Intervention/Exposure; Outcome; Exp-outcome not tested
35.	Kelleher, CC, Viljoen, K, Khalil, H, Somerville, R, O'Brien, J, Shrivastava, A, Murrin, C. Longitudinal follow-up of the relationship between dietary intake and growth and development in the Lifeways cross-generation cohort study 2001-2013. Proc Nutr Soc. 2014. 73:118-31. doi:10.1017/s002966511300373x.	Study design
36.	Kemp, AS, Ponsonby, AL, Dwyer, T, Cochrane, JA, Pezic, A, Jones, G. Maternal antenatal peanut consumption and peanut and rye sensitization in the offspring at adolescence. Clin Exp Allergy. 2011. 41:224-31. doi:10.1111/j.1365-2222.2010.03668.x.	Study design; Outcome
37.	Kim, YH, Kim, KW, Lee, SY, Koo, KO, Kwon, SO, Seo, JH, Suh, DI, Shin, YH, Ahn, K, Oh, SY, Lee, S, Sohn, MH, Hong, SJ. Maternal Perinatal Dietary Patterns Affect Food Allergy Development in Susceptible Infants. J Allergy Clin Immunol Pract. 2019. 7:2337-2347.e7. doi:10.1016/j.jaip.2019.03.026.	Outcome; Did not require skin prick test; No obvious food challenge
38.	Kusmierek, M, Sardecka, I, Los-Rycharska, E, Krogulska, A. The impact of immunomodulatory factors from maternal diet during pregnancy on cow's milk allergy in offspring - A pilot study in the paediatric population of the Kuyavian-Pomeranian Voivodship. Allergol Immunopathol (Madr). 2019. 47:570-578. doi:10.1016/j.aller.2019.04.007.	Study design; Health Status
39.	Levin, ME, Botha, M, Basera, W, Facey-Thomas, HE, Gaunt, B, Gray, CL, Kiragu, W, Ramjith, J, Watkins, A, Genuneit, J. Environmental factors associated with allergy in urban and rural children from the South African Food Allergy (SAFFA) cohort. J Allergy Clin Immunol. 2020. 145:415-426. doi:10.1016/j.jaci.2019.07.048.	Study design; Population

	Citation	Rationale
40.	Lilja, G, Dannaeus, A, Foucard, T, Graff-Lonnevig, V, Johansson, SG, Oman, H. Effects of maternal diet during late pregnancy and lactation on the development of IgE and egg- and milk-specific IgE and IgG antibodies in infants. Clin Exp Allergy. 1991. 21:195-202. doi:10.1111/j.1365-2222.1991.tb00830.x.	Outcome
41.	Linnamaa, P, Nieminen, K, Koulu, L, Tuomasjukka, S, Kallio, H, Yang, B, Tahvonen, R, Savolainen, J. Black currant seed oil supplementation of mothers enhances IFN-gamma and suppresses IL-4 production in breast milk. Pediatr Allergy Immunol. 2013. 24:562-6. doi:10.1111/pai.12110.	Intervention/Exposure; Outcome
42.	Linnamaa, P, Savolainen, J, Koulu, L, Tuomasjukka, S, Kallio, H, Yang, B, Vahlberg, T, Tahvonen, R. Blackcurrant seed oil for prevention of atopic dermatitis in newborns: a randomized, double-blind, placebo-controlled trial. Clin Exp Allergy. 2010. 40:1247-55. doi:10.1111/j.1365-2222.2010.03540.x.	Intervention/Exposure
43.	Losol, P, Rezwan, FI, Patil, VK, Venter, C, Ewart, S, Zhang, H, Arshad, SH, Karmaus, W, Holloway, JW. Effect of gestational oily fish intake on the risk of allergy in children may be influenced by FADS1/2, ELOVL5 expression and DNA methylation. Genes Nutr. 2019. 14:20. doi:10.1186/s12263-019-0644-8.	Intervention/Exposure; Outcome; No exp-outcome test
44.	Ludvigsson, J. Cow-milk-free diet during last trimester of pregnancy does not influence diabetes-related autoantibodies in nondiabetic children. Ann N Y Acad Sci. 2003. 1005:275-8. doi:10.1196/annals.1288.042.	Outcome
45.	Lumia, M, Luukkainen, P, Tapanainen, H, Kaila, M, Erkkola, M, Uusitalo, L, Niinisto, S, Kenward, MG, Ilonen, J, Simell, O, Knip, M, Veijola, R, Virtanen, SM. Dietary fatty acid composition during pregnancy and the risk of asthma in the offspring. Pediatr Allergy Immunol. 2011. 22:827-35. doi:10.1111/j.1399-3038.2011.01202.x.	Study design; Diet assessed after birth
46.	Martin-Munoz, MF, Pineda, F, Garcia Parrado, G, Guillen, D, Rivero, D, Belver, T, Quirce, S. Food allergy in breastfeeding babies. Hidden allergens in human milk. Eur Ann Allergy Clin Immunol. 2016. 48:123-8.	Study design
47.	Miyake, Y, Tanaka, K, Yasutake, A, Sasaki, S, Hirota, Y. Lack of association of mercury with risk of wheeze and eczema in Japanese children: the Osaka Maternal and Child Health Study. Environ Res. 2011. 111:1180-4. doi:10.1016/j.envres.2011.07.003.	Intervention/Exposure;
48.	Nascimento, JXPT, Ribeiro, CCC, Batista, RFL, de Britto Alves, MTSS, Simoes, VMF, Padilha, LL, Cardoso, VC, Vianna, EO, Bettiol, H, Barbieri, MA, Silva, AAMD. The First 1000 Days of Life Factors Associated with "Childhood Asthma Symptoms": Brisa Cohort, Brazil. Sci Rep. 2017. 7:16028. doi:10.1038/s41598-017-16295-4.	Outcome; <2y old
49.	Neild, V. Diet and atopic eczema. Mod Midwife. 1994. 4:22.	Study design; Not a study
50.	Ngamphaiboon, J, Chatchatee, P, Thongkaew, T. Cow's milk allergy in Thai children. Asian Pac J Allergy Immunol. 2008. 26:199-204.	Country; Health Status

	Citation	Rationale
51.	Nwaru, BI, Ahonen, S, Kaila, M, Erkkola, M, Haapala, AM, Kronberg-Kippila, C, Veijola, R, Ilonen, J, Simell, O, Knip, M, Virtanen, SM. Maternal diet during pregnancy and allergic sensitization in the offspring by 5 yrs of age: a prospective cohort study. Pediatr Allergy Immunol. 2010. 21:29-37. doi:10.1111/j.1399-3038.2009.00949.x.	Outcome
52.	Nwaru, BI, Erkkola, M, Ahonen, S, Kaila, M, Lumia, M, Prasad, M, Haapala, AM, Kronberg-Kippila, C, Veijola, R, Ilonen, J, Simell, O, Knip, M, Virtanen, SM. Maternal diet during lactation and allergic sensitization in the offspring at age of 5. Pediatr Allergy Immunol. 2011. 22:334-41. doi:10.1111/j.1399-3038.2010.01114.x.	Outcome
53.	Nwaru, BI, Erkkola, M, Lumia, M, Kronberg-Kippila, C, Ahonen, S, Kaila, M, Ilonen, J, Simell, O, Knip, M, Veijola, R, Virtanen, SM. Maternal intake of fatty acids during pregnancy and allergies in the offspring. Br J Nutr. 2012. 108:720-32. doi:10.1017/s0007114511005940.	Study design; Diet assessed after birth
54.	Oien, T, Storro, O, Johnsen, R. Do early intake of fish and fish oil protect against eczema and doctor-diagnosed asthma at 2 years of age? A cohort study. J Epidemiol Community Health. 2010. 64:124-9. doi:10.1136/jech.2008.084921.	Study design; Population
55.	Olsen, SF, Osterdal, ML, Salvig, JD, Mortensen, LM, Rytter, D, Secher, NJ, Henriksen, TB. Fish oil intake compared with olive oil intake in late pregnancy and asthma in the offspring: 16 y of registry-based follow-up from a randomized controlled trial. Am J Clin Nutr. 2008. 88:167-75. doi:10.1093/ajcn/88.1.167.	Intervention/Exposure;
56.	Ozawa, N, Shimojo, N, Suzuki, Y, Ochiai, S, Nakano, T, Morita, Y, Inoue, Y, Arima, T, Suzuki, S, Kohno, Y. Maternal intake of Natto, a Japan's traditional fermented soybean food, during pregnancy and the risk of eczema in Japanese babies. Allergol Int. 2014. 63:261-6. doi:10.2332/allergolint.13-OA-0613.	Diet assessed after birth
57.	Pele, F, Bajeux, E, Gendron, H, Monfort, C, Rouget, F, Multigner, L, Viel, JF, Cordier, S. Maternal fish and shellfish consumption and wheeze, eczema and food allergy at age two: a prospective cohort study in Brittany, France. Environ Health. 2013. 12:102. doi:10.1186/1476-069x-12-102.	Population; Diet assessed before pregnancy
58.	Romieu, I, Torrent, M, Garcia-Esteban, R, Ferrer, C, Ribas-Fito, N, Anto, JM, Sunyer, J. Maternal fish intake during pregnancy and atopy and asthma in infancy. Clin Exp Allergy. 2007. 37:518-25. doi:10.1111/j.1365-2222.2007.02685.x.	Study design; Population
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	Citation	Rationale
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